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An annotated list of Radiocarbon dates for Sub-Saharan Africa

It is fourteen years since J. Janmart submitted the first samples for radiocarbon dating from Sub-Saharan Africa, and there are now some 181 published dates for this area which are of interest to the prehistorian and research worker in the field of Quaternary studies. This paper is an attempt to assemble all the available dates published to the end of 1964 and the information pertinent to their interpretation in a single list for ease of reference.

The Carbon-14 dating method was developed by W. F. Libby in the late 1940's while engaged in research on the effects of cosmic ray bombardment of the upper atmosphere. He was able to show that the neutrons formed through cosmic rays colliding with nitrogen atoms produce the radio-isotope C14. This combines with oxygen to form a very small percentage of radiocarbon dioxide in addition to the normal CO_2 content of the atmosphere. All living matter, depending as it does on the intake of CO_2, therefore incorporates radiocarbon into its cells and all organisms therefore contain a proportion of radiocarbon in equilibrium with the atmosphere. After death the amount of radiocarbon diminishes by radioactive decay at a fixed rate so that by measuring the residual radioactivity in a sample it is possible to calculate the age of the specimen. Carbon-14 has a half-life of approximately 5730 ± 40 years, and after some 50,000 years the amount which remains is normally too small to measure thus placing a limit on the range of the method.

The method depends on the basic assumption that the percentage of radiocarbon content in the biosphere has remained substantially constant over the period of about 50,000 years for which the dating method is applicable. During the last 150 years, however, this balance has been altered by the extensive burning of fossil fuels such as coal and oil (Suess effect) and by the release of radiocarbon into the atmosphere through the explosion of nuclear bombs. However, these effects are a known quantity and the basic assumption is considered valid.

Anomalies in dates are caused by a variety of factors. In order to minimize the effects of contamination, there are certain pretreatment techniques which are necessary to remove humic acids and organic material and these are employed by most laboratories today. In general, dates which are considered too young can be due to the penetration of the subsoil by modern tree rootlets and the introduction of humic acids. Anomalously old dates are generally due to the addition of fossil carbon and are encountered in freshwater mollusc shells (2) and to a lesser degree in marine shells, possibly due to a dilution effect resulting from the incorporation of inactive carbon derived from limestone and old humus, and also to the uneven absorption of Carbon-14 at the air-water interface (2). Resultant errors may be as great at 3000 years for modern shell samples from rivers actively cutting into old flood plains or old soil profiles (2). Isotopic fractionation or the preferential take-up of Carbon-14 (or of the lighter isotope of Carbon-12 which has the reverse effect) by the living organism will cause anomalies in the dates, making them too old (10). The use of charred ostrich eggshell as a medium for dating has also been experimented with (3), but the results were considered far too old and may possibly be due to the food habits of the ostrich.

Experiments have increased the range of materials which are now able to be used for dating purposes. The essential feature of all material suitable for radiocarbon dating is that it should be organic or that its carbon should have been derived directly or indirectly from atmospheric carbon dioxide (12). The most suitable material is charcoal where the tendency to absorb humic acids is offset by pretreatment, and other reliable materials are wood, peat, nuts, leaves, flesh, hair, etc. Bone has a relatively low carbon content and large amounts are therefore needed for processing; a method of dating bone and shell has been developed where the organic carbon (collagen in bone, conchiolin in marine shell) is separated by pretreatment from the other mineral constituents and is dated in the usual manner, but due to the decrease in the quantity of collagen with the age of the sample, the oldest specimen dated is only about 9000 years old (13). In addition, carbonates in the form of caliche, dolomite, calcite and calc tufa have been used for dating purposes in the U.S.A. and from Australia (14, 15); in Europe, the organic matter in soils and lake muds has been used to date old land surfaces and stratigraphic horizons (17).

Since the first dates were published, experiments have continued and changes have been made both in the methods of processing of the samples and in the manner of the calculation and publication of the dates. Valuable work by Haring and De Vries has extended the limit of the method back in time to about 70,000 years by an enrichment process (16) which has been used for a sample from Africa (Kalambo Falls).

Earlier determinations (before about 1956) were often run by converting the sample to solid carbon before counting; work by Libby (11), has shown that gas proportional counters are more efficient and these are in general use today. Dates processed with the solid carbon method (which tend to be younger but are not consistently so) are marked by an asterisk in the lists below. Re-calculations of the half-life of C-14 have given a value of 5730 ± 40 years (4), the mean of three determinations, and this appears to be a closer approximation to the true half-life than the earlier values. However, in accordance with a decision of the Fifth Radiocarbon Dating Conference in Cambridge in 1962, made so as to gain time for further study before the re-publication of all dates is agreed upon, it was decided that all dates published be based on the original Libby value of 5570 ± 30 years (5). Prior to 1962, laboratories worked variously on the Libby value, or on 5568 ± 30 (Lamont (6), British Museum (7)), or on 5760 ± 40 (Louvain (8)).

The members of the Fifth Radiocarbon Dating Conference also agreed that all dates be calculated at B. P. (before the Present) 1950 (5). As a result there will be discrepancies between the A. D. / B. C. dates published here and some of those published elsewhere before 1962.

The standard deviation which accompanies each date is a statistical error encountered in the methods of counting and is not an absolute error. As explained by Robins and Swart (1), if a sample is reported at 3220 ± 120 years, there is a 2 out of 3 chance that it is between 3100 and 3340 years old, 19 chances in 20 that it is between 2980 and 3460 years old and 997 chances in 1000 that it is between 2860 and 3580 years old.

In compiling this list, a few discrepancies have been noted between dates published by the laboratories and the dates published in other papers. In such cases, the date published by the laboratory is taken as the correct one. In the case of a date not having been published by the laboratory, the date published first has been accepted here.

Structure of the Lists:

The dates published here have been grouped into three major sections:

(a) Geological and Tree-ring dates
(b) Archaeological dates, subdivided into:
    1. Early Stone Age and First Intermediate
    2. Middle Stone Age and Second Intermediate
    3. Later Stone Age
    4. Iron Age
(c) Dates of Paleo-environmental interest, the list being composed largely of dates already listed in the other two sections.

Further subdivision of Sections A and B is based on geographical areas defined on the map in Fig. 1.

Column 1 lists the Laboratory numbers of the dates prefixed by the laboratory code letters which are explained in Table 2. These are followed by the date as published by the laboratory with the Before Present value above, accompanied by the standard deviation, and the A. D. / B. C. date (calculated from 1950) below. Column 3 gives the name of the site, followed by the country. Exact localities are shown on Fig. 1, and the geographical co-ordinates are given where available in the additional notes. The cultural associations (as recognized by the excavator or submittor) are listed next, followed by the type of material submitted for dating (charcoal, peat, shell, etc.). The numbers in the last column refer to the bibliographic reference of the date quoted in the list, and these references are listed at the end of the section in question.

An asterisk in the left hand margin indicates that the solid carbon counting method was used; a query in the left hand margin indicates that either the laboratory or the excavator are not satisfied that the date is accurate.

The dates are arranged in rough chronological order, this order being interrupted where it was found more convenient to group the dates by site.

The additional notes accompanying each list have been compiled from the information accompanying each result published by the laboratory, and from any additional information in published papers which have been available to this author. Numbers in parenthesis in the text refer to bibliographic references at the end of the section.

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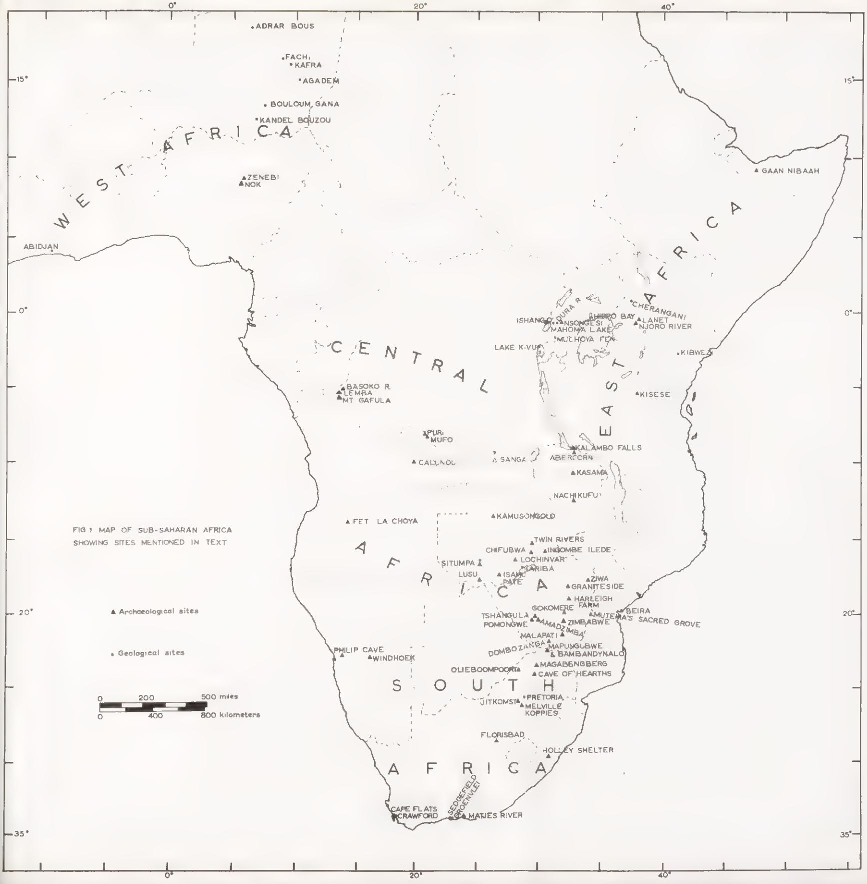

FIG 1 MAP OF SUB-SAHARAN AFRICA SHOWING SITES MENTIONED IN TEXT

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A. GEOLOGICAL AND TREE RING DATES

	Lab. No.	Date B.P. B.C.	Site	Associations	Sample	Reference
a.	SOUTH AFRICA					
1.	W-246	> 38,000	Cape Flats	Pertinent to geological history of Cape Flats	Charcoal	1
2.	Y-49	> 38,000	"	"	Wood	2
3.	Y-106	> 36,000	Crawford, Cape	"	"	"
4.	Y-468	37,700 ± 2000 35,750 BC	Sedgefield, Knysna	Beach at 4m above present sea level	Marine shell	9
5.	Y-466	6870 ± 160 4920 BC	Groenvlei, Knysna	Marine incursion at 5.8m below fen surface	Humified freshwater peat	4
6.	Y-467	1905 ± 60 45 AD	"	2.9m below fen surface	Gyttja	"
7.	SR-3	560 ± 100 1390 AD	Beira, Mocambique	Recession of coastal lagoon	Wood	11
8.	SR-5	750 ± 100 1200 AD	Wonderboom, Pretoria	Wood from heart of tree	Wood	"
9.	SR-4	350 ± 100 1600 AD	"	Wood from 6' from heart of tree	"	"
b.	CENTRAL AFRICA					
10.	L-349B	14,000 ± 600 12,050 BC	Lake Kivu, Congo	Old shoreline	Shells	3
11.	L-349A	12,450 ± 350 10,500 BC	Lake Kivu, Ruanda	100m terrace above lake	"	"
12.	Lv-17	7840 ± 190 5890 BC	Lemba, Congo	Dates time when present desert was Equatorial forest	Fossil wood	13
13.	SR-24	1930 ± 100 AD 20	Situmpa Forest Zambia	Useful for dating of Kalahari sands	Charcoal	12
14.	SR-2	1010 ± 100 AD 940	Lake Kariba, Baobab tree	Heart of baobab tree of 15' diameter	Wood	11
15.	SR-1	740 ± 100 AD 1210	"	Midway between outside and centre of tree	"	"
c.	EAST AFRICA					
16.	I-556	14,700 ± 290 12,750 BC	Mahoma Lake, Uganda	Minimum date for glacial retreat	Gyttja	8
17.	NPL-54	12,890 ± 130 10,940 BC	Muchoya Fen, Uganda	To correlate climatic sequence in NW Europe and E Africa	Peat	10
18.	NPL-53	9340 ± 100 7390 BC	"	"	"	"
19.	NPL-52	6570 ± 95 4620 BC	"	"	"	"
20.	Y-568	7530 ± 450 5580 BC	Dura River, Uganda	70'-100' old level of Lake George	Carbonized Wood	5

c. EAST AFRICA (cont.)

	Lab. No.	Date B. P. B. C.	Site	Associations	Sample	Reference
?21.	Y-611	Modern	Dwemkorebe River Uganda	Sample contaminated	Peaty material	5
22.	Y-688	3720 ± 120 1770 BC	Hippo Bay Cave, Uganda	Dates last high shoreline of Lake Victoria	Charcoal	"
23.	W-749	480 ± 200 AD 1470	Kibwezi, Kenya	From beneath a lava flow around a spring	Charcoal	7
d.	WEST AFRICA					
24.	U-266	950 ± 70 AD 1000	Abidjan, Ivory Coast	Beach 48m above salt water lagoon	Shell	14
25.	U-265	990 ± 70 AD 960	"	"	"	"
26.	U-264	970 ± 110 AD 980	"	"	"	"
27.	T-340B	21,350 ± 350 19,400 BC	Fachi, Niger	Old level of ancient Lake Chad	Lacustrine limestone	15
28.	T-280	9150 ± 200 7200 BC	Bouloum Gana, Niger	"	Diatomite	"
29.	T-338A	8580 ± 110 6630 BC	Agadem, Niger	"	"	"
30.	T-338B	9240 ± 130 7290 BC	"	"	"	"
31.	T-341	7000 ± 100 5050 BC	Kafra, Niger	"	Limestone	"
32.	T-361	7310 ± 120 5360 BC	Adrar Bous, Niger	"	"	"
33.	T-279	6900 ± 150 4950 BC	Kandel Bouzou Niger	"	Carbonized organic fragments	"
e.	ISLANDS					
34.	Q-417	4720 ± 130 2770 BC	Albatross Plain, Gough Island	Vegetation pattern very uniform over last 4700 years	Peat	6
35.	Q-418	2345 ± 120 395 BC	"	"	"	"
36.	GaK-277	2250 ± 420 300 BC	Baie des Galions, Madagascar	Wave cut notch at 1.4m above sea level	Shell	16

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ADDITIONAL NOTES ON GEOLOGICAL AND TREE RING DATES

1. **W-246. Cape Flats, South Africa** > 38,000

Charcoal from under 35-40 feet of sand resting on clay in the Cape Flats. The geologic history of the Cape Flats in uncertain, and the date has a bearing on whether the Cape Flats was a shallow straits recently or whether the sand was windblown. Collected by S.S. Amdurer, University of Cape Town (1). Results have not yet been published.

2. **Y-49. Cape Flats, South Africa** > 38,000

Podocarp wood from 20' below the surface of a sandy deposit forming part of the Cape Flats, the low-lying area separating the Cape Peninsula from the mainland. Submitted by the South African Museum, Cape Town. (2)

3. **Y-106. Crawford, Cape Province, South Africa** > 36,300

Podocarp wood from 27' below the surface of a 70' terrace (17) forming part of the Cape Flats. **Comment**: The terrace is probably older than the last interglacial age. The two measurements (Y-49 and Y-106) cast no doubt on the supposition that the wood belongs to the terrace, but do not provide an adequate date for the last separation of the Cape Peninsula from the mainland. (2)

4. **Y-468. Sedgefield, Knysna, South Africa** 37,700 ± 2000
35,750 BC

Marine shells from a beach ca. 4m above sea level (4m above top of marine layer at Groenvlei, bracketed between dates of 6870 and 1905 BP - this list no. 5 and 6), buried below a flat sandy plain, believed to be formed subaerially, whose surface forms a terrace at Sedgefield (34°01'S; 22°48'E), 2 miles west of Groenvlei and about 2 miles inland from the present coast. Upper sandy portion of the section contains a red cemented band, thought to be part of a fossil soil and postdating the shells; shells include **Calliostoma fultoni**, not now living south of Delagoa Bay, 8° of latitude further north, and **Cerithium kochi**, and Indo-Pacific species of similar implication, though still found at Algoa Bay, about 180 miles east and 1° of latitude further north of Sedgefield. Collected in 1956 and submitted by A.R.H. Martin, University of Sydney, Australia. **Comment**: Shell bed is thought to belong to an older, higher sealevel than that recorded at Groenvlei. **Calliostoma fultoni** is recorded from a similar beach at Klein Brak River, 40 miles west where it was regarded as evidence of a postglacial hypsithermal interval, or as Last Interglacial. Older, higher marine features in the district, recording a sealevel at least 7 or 8 m above the present one, belong to a group commonly thought to be of last interglacial (Monastirian II) age. Features at 4 to 5 m above present sealevel, including the dated beach at Sedgefield, were ascribed by Krige to a "resting stage in the last emergence", and may belong to the Epimonastirian of Zeuner, which may date from the interval between Early and Main Wurm. The date and the geomorphic evidence of youthfulness favor such an assignment, but the climatic implications of the shells (sea-surface temperatures about 5°C higher than today's) does not. A postglacial date is clearly ruled out, and there is no evidence of a postglacial sealevel more than 1.5m above the present one in the Knysna district. The possibility of slight contamination of the shells by modern (atmospheric) C14, always present when very old carbonate is used for dating, makes it impossible to be sure that the Sedgefield deposit is not beyond the limit of C14 dating, and therefore probably of last interglacial (Eemian) age; but the shells were not exposed to air until collection, and contamination is not particularly likely. (9, 18, 19, 20).

Groenvlei series, South Africa

Peat and gyttja from fen deposits at Groenvlei (33° 48'S, 22° 52'E), a coastal lagoon in the Knysna division, South Africa. Borings show marine mud intercalated in the freshwater deposits, beginning at 5.8m below the surface of the fen (about 3m below mean sealevel), and grading upward into brackish water and then to freshwater deposits. Brackish water diatoms have their maximum appearance at 3.6m below the fen surface, and a fully freshwater diatom assemblage was re-established by 1.7m. Pollen analysis shows that heath vegetation predominated from the beginning of deposition until the return to freshwater conditions commenced. Collected 1956 and submitted by A.R.H. Martin, University of Sydney, Australia. (4, 18, 19, 20).

5. **Y-466 Groenvlei, lower freshwater layer** 6870 ± 160
4920 BC

Humified freshwater peat from three 10cm portions of a 30cm core, collected by a Hiller borer immediately below the level of marine mud at 5.8m below the fen surface. (4)

6. **Y-467 Groenvlei, upper freshwater layer** 1905 ± 60
45 AD

Gyttja from 2.9m below the fen surface overlying marine and brackish water deposits; collected by post-hole auger. **Comment**: The marine incursion, which never seems to have reached a higher level than that of today's, is bracketed between the age of the Boreal-Atlantic transition and the beginning of the sub-Atlantic time in Europe. (4)

7. **SR-3 Estoril Beach Camp, Beira, Mozambique** 560 ± 100
AD 1390

Wood of **Avicennia marina** found 2 miles north of the Estoril Beach Camp (19° 45'S, 35° 0'E). Wood was imbedded in lagoon mud and had been exposed by coastal erosion. Collected by A.D. Boughey, U.C.R.N., Salisbury. **Comment**: By analogy with the relationship between the existing coastline and the present lagoon, date gives an estimate of the time taken by this stretch of coast to overrun the lagoon in which this tree once grew. (11)

8. **SR-5 Wonderboom, Pretoria** 750 ± 100
AD 1200

Wood sample taken five ft. from the heart of the tree known as the Wonderboom (**Ficus pretoriae** Burtt-Davey) (25° 36'S; 28° 12'E). Collected by J.E.

Repton, submitted by H. Bruins-Lich, Parks and Recreation Dept., Pretoria. (11)

9. **SR-4 Wonderboom, Pretoria** 350 ± 100
1600 AD

Wood taken 6ft. from the heart of the same tree as SR-5. **Comment**: Because of the enormous size of the Wonderboom its age has long been a considerable source of interest. In the absence of any extant heartwood, the age of the tree is estimated, on the basis of the above dates and the existing size of the tree, to be about 1000 years. (11)

10. **L-349B Lake Kivu, Belgian Congo** 14,000 ± 600
12,050 BC

Lamellibranch shells from Kiritshe beach, Belgian Congo (1° 36'S; 29° 02'E) at the northwest corner of Lake Kivu. Originally it was thought that the shells should be modern, but the old radiocarbon age is considered consistent with two facts pointing to the shells being ancient: (i) no living lamellibranch molluscs have been found in the vicinity, and (ii) excavated pits in the area show a nearly continuous buried shell layer. Thus the shell age probably dates a former level of the lake close to the present level. Lake Kivu must have passed the present level before reaching the high level dated by sample L-349A. Collected in 1955 by A. Meyer; submitted by the Director of the Geological Survey of the Belgian Congo. **Comment**: The age is based on an initial C14/C12 ration equal to that in atmospheric CO_2 and hence must be considered maximum. (3)

11. **L-349A Lake Kivu, Ruanda** 12,450 ± 350
10,500 BC

Shells from a terrace 330' (100m) above the level of Lake Kivu at Kisenyi (1° 42'S; 29° 16'E), Ruanda. Sample was imbedded in a sandy-clay bed interstratified with coarse sand and volcanic ash at the former mouth of the Sebeya stream. Apparently the shells date a high level of the lake. Collected 1955 by A. Meyer and submitted by the Director of the Geological Survey of the Belgian Congo. (3)

12. **Lv-17 Lemba, Congo** 7840 ± 190
5890 BC

Fossil wood from dried-out fen, collected during construction of a road at Lemba (4° 23'S; 15° 20'E), Province of Leopoldville. Collected 1957 and submitted by W. Van Pée, Louvanium University, Leopoldville. **Comment**: Date indicates a time when the site, presently a desert, was occupied by equatorial forest (13). Details of the type of wood, etc. are not yet published.

13. **SR-24 Situmpa Forest Station, Zambia** 1930 ± 100
AD 20

Charcoal sample from charcoal levels in the Kalahari sand at a depth of 42 ins. Geographical position: 16° 50'S; 25° 07'E. Submitted by B. Fagan, Rhodes-Livingstone Museum, Zambia. **Comment**: Sample is of stratigraphical importance over some distance and ties in with sample C-829 (see Iron Age list)

(12), but details of its implication have not yet been published.

14. **SR-2 Baobab Tree heartwood, Lake Kariba** 1010 ± 100
940 AD

Wood from the heart of tree **Adonsonia digitata L.** from bush-clearing operations at Lake Kariba (16° 55'S; 28° 05'E), in Rhodesia. **Comment**: Since many Baobab trees grow to a diameter greater than 20 ft. the indications are that many of them are more than 1000 years old. (11)

15. **SR-1 Baobab Tree** 740 ± 100
AD 1210

Wood sample from same tree as above, taken from midway between the centre and the outside of its 15 ft. diameter. Collected and submitted by E. Swart. (11)

16. **I-556 Mahoma Lake, Uganda** 14,700 ± 290
12,750 BC

Gyttja from Mahoma Lake (0° 21'N; 29° 58'E), altitude 3000m, the lowest glacial lake in the Ruwenzori range. Sample from 5.2 to 5.4m depth in lake sediment at a station in 0.5m of water. Collected 1960 and submitted 1962 by D.A. Livingstone, Duke University, Durham, North Carolina U.S.A. **Comment**: Date is a minimum for and probably close to the true age of the glacial retreat from the lowest valley moraines. This is the first known direct dating of any glacial event in equatorial Africa, and indicates that retreat from the last glacial maximum was synchronous with that in the temperate zone. (8, 21)

Muchoya Fen series, Uganda

Peat, separate cores from a Hiller drill, from Muchoya Fen, 8000 ft. above sealevel within Echuya Central Forest Reserve (1° 30'S; 30°E). Collected 1960 and submitted by M.E.S. Morrison, Makerere University College, Uganda. (10)

17. **NPL-54 Muchoya Fen, depth 750-800 cm** 12,890 ± 130
10,940 BC

18. **NPL-53 Muchoya Fen, depth 600-650 cm** 9340 ± 100
7390 BC

19. **NPL-52 Muchoya Fen, depth 400-450 cm** 6570 ± 95
4620 BC

General comment: The fen, within the area of Bufumbira volcanic bay, is in the equatorial belt and enjoys a somewhat temperate climate throughout the year. The profile was analysed at consecutive small vertical intervals for its pollen content. Results should be important in correlation of late Quaternary cliamtic and vegetation sequences in NW Europe and equatorial East Africa. (10, 22)

Dura River series, Uganda

Carbonized wood and peaty material imbedded in and overlain by travertine limestones, exposed in the valley of the Dura River (0° 12'N; 30° 18'E) and its tributary the Dwemkorebe River, western Uganda. The travertines occur interbedded with apparently lacustrine limestones, laid down when the level of Lake George in this region stood 70 to 100 ft. above its present altitude of 2997 ft. above O.D. (23). The deposits, with maximum observed thickness of 50 ft. overlie fluvio-lacustrine gravel. Collected 1957 by R. Seal; submitted by W.W. Bishop, Geological Survey of Uganda (10).

20. **Y-568 Dura River** 7530 ± 450
5580 BC

Carbonized wood imbedded in travertine, collected from a spoil dump near the main outcrop where the limestones attain maximum observed thickness (5).

21. **Y-611 Dwemkorebe River** Modern

Carbonized wood and peaty material from below the limestone, occurring along the Dwemkorebe valley. **Comment**: If the limestones were in part lacustrine, a relative upwarp of 40 to 50 ft. must have taken place since their formation as there is firm evidence south-west of Lake George that the lake was within 30 ft. of its present level prior to the deposition of the Katwe volcanic ash, dated by de Heinzelin (24) at about 8000 years B. P. The ash is post-dated by local faults and hence comparatively recent tectonic activity is confirmed for the region. However, it is possible that in addition to the travertine much of the limestone arises from subaerial spring action (5).

22. **Y-688 Hippo Bay Cave, Entebbe, Uganda** 3720 ± 120
1770 BC

Charcoal from a lens of sand 9 ins. thick, interpreted as part of an emerged beach. Stratigraphic succession shows a wave-cut platform of lateritic ironstone at the base, the lens of sand dated, a 1-2 ins. gravel layer and then pottery-rich occupation layers in a small cave on the western headland of Hippo Bay (0^o 03'N; 32^o 27'E), at an altitude of 8 ft. above Lake Victoria (25). The charcoal is presumably indicative of human activity but has been rounded by wave action; it dates the last and lowest former high shoreline (ca. 12 ft. above lake level) of Lake Victoria (26); the high lake level is considered not to have resulted from crustal movement, but probably marks a stillstand in down-cutting of the lake outlet at Jinja. Collected in 1957 and submitted by W.W. Bishop, Geological Survey of Uganda (5).

23. **W-749 Kibwezi, Kenya** 480 ± 200
AD 1470

Charcoal from near Kibwezi, 120 miles south-east of Nairobi (2^o 30'S, 38^o 10'E). From beneath a lava flow and above a limestone deposited around a spring. Collected 1957 by R.G. Dodson, submitted by A.O. Thompson, Mines and Geological Dept., Nairobi. (7)

24. **U-266 Abidjan, Ivory Coast** 950 ± 70
AD 1000

Salt water lagoon mollusc shells, accumulated by wave action, from Adiopodioume, Abidjan (5^o 10'N; 3^o 50'W), Ivory Coast. Sample from a 50 cm thick layer of shells, at an altitude of 48m. Collected 1960 and submitted by

J. Tricart, University of Strasbourg, France. This dates the inner 17% of the sample (14). Wave action at this altitude appears anomalous.

25. **U-265 Abidjan, Ivory Coast** 990 ± 70
AD 960

This dates the layer corresponding to 34% of the shells. (14)

26. **U-264 Abidjan, Ivory Coast** 970 ± 110
AD 980

Outer layer of shells corresponding to 42%. (14)

Niger Series

Lacustrine sediments in areas of East Niger now deserts, have been correlated with a long humid period in the Quaternary; an immense Lake Chad covered a large part of Niger, from Tenere desert in the south-east towards the present Lake Chad. Sediments are between ancient dunes of sand and more recent eolian sands. Six C14 dates from these sediments, all collected 1954-1962 and submitted by H. Faure, University of Dakar, show that the end of the lacustrine period was probably ca. 7000 years B. P. The dates indicate that humid periods in the Sahara do not necessarily correspond to European Ice Ages (15, 27).

27. **T-340 B Fachi, Niger** 21,350 ± 350
19,400 BC

Lacustrine limestone from Fachi (18° 03'N; 11° 40'E), underlying a layer of diatomite. Limestone was impure with **Phragmites**. **Comment**: Date may correspond to a low stratigraphic horizon. Assuming rate of sedimentation to be 3 to 5m of diatomite in 10,000 to 15,000 years, the sample could belong to the same lacustrine period as the others. The date does not, however, indicate the beginning of this period, as diatomite underlies the dated layer. (15)

28. **T-280 Bouloum Gana, East Niger** 9150 ± 200
7200 BC

Diatomite from Bouloum Gana (15° 01'N; 10° 37'E), from a well at an altitude of 390m, from a sequence of lacustrine sediments. (15)

29. **T-338 A Agadem, East Niger** 8580 ± 110
6630 BC

Pure diatomite from the principal layer in a lacustrine deposit of clay or mud, locally mixed with limestone containing numerous silicified stems of **Phragmites**. Geographical position: 16°50'N; 13°20'E. (15)

30. **T-338 B Agadem, East Niger** 9240 ± 130
7290 BC

Impure diatomite imbedded in mud from a lower position than T-338 A. (15)

31. **T-341 Kafra, East Niger** 7000 ± 100
5050 BC

Lacustrine limestone from Kafra (18° 59'N; 12° 20'E), with **Phragmites**. **Comment**: Probably represents the end of the lacustrine period. See also comment of T-361. (15)

32. **T-361 Adrar Bous, East Niger** 7310 ± 120
5360 BC

Lacustrine limestone from Adrar Bous (20° 18'N; 09° 02'E), altitude 700m. As the sediments here have a difference of altitude of more than 300m from those of the eastern part of Tenere Fachi, there may have been separate lakes in this district. **Comment**: The date is close to that of T-341 and in these two cases limestone represents the last lacustrine sediments overlying diatomites. Dates thus probably mark the end of the humid period in the south and central Sahara. (15).

33. **T-279 Kandel Bouzou, East Niger** 6900 ± 150
4950 BC

Carbonized organic fragments (moss and water plants) from Kandel Bouzou (15° 24'N; 10° 59'E), found in black sandy mud, altitude 385m, probably a former bog beneath sand with Neolithic pottery. **Comment**: Date may indicate the end of a great humid period; it agrees with that of the inorganic carbonates (T-361 and T-341). (15)

34. **Q-417 Albatross Plain, Gough Island. 213-218cm** 4720 ± 130
2770 BC

Sphagnum-Cyperaceae-**Empetrum** peat (40° 20'S; 10°W), at the base of a pollen analyzed series and situated immediately over bedrock. Collected 1957 by N. M. Wace and M. Holdgate. **Comment**: This date in conjunction with the pollen analyses establishes a remarkably uniform vegetation for the past 4700 years. (6)

35. **Q-418 Albatross Plain, Gough Island. 180-184 cm** 2345 ± 120
395 BC

Peat enclosing a thin layer of volcanic ash, from the same boring as Q-417. **Comment**: This establishes a date for a volcanic eruption on the island (possibly the latest); the 40 cm of peat between the two samples would seem to represent as long a time period as the 180 cm formed after Q-417 was deposited. (6)

36. **GaK-277 Baie des Galions, Madagascar** 2250 ± 420
300 BC

Shell from a wave-cut notch at Baie des Galions (25° 30'S; 46° 30'E). The notch is 1 to 1.4 m above the similar notch corresponding to present sealevel. Collected 1957 and submitted by R. Battistini, University of Madagascar. **Comment**: Dates the period in which sealevel was 1 to 1.4 m higher than the present level. Similar notches are frequent on the south and west coasts of Madagascar. (16, 28)

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B. ARCHAEOLOGICAL DATES

I. Early Stone Age and First Intermediate

a. SOUTH AFRICA

no dates

b. CENTRAL AFRICA

Lab. No.	Date $\frac{\text{B.P.}}{\text{B.C.}}$	Site	Associations	Sample	Reference
1. GrN-2644	57,600 ± 750 55,650 BC	Kalambo Falls, Zambia	Late Acheulian	Wood	1
2. GrN-1396	> 52,000	"	"	"	"
3. GrN-3211	> 49,000	"	Lowest Sangoan	"	"
4. GrN-3226	46,100 $^{+3500}_{-2400}$ 44,150 BC	"	"	Charcoal	"
5. L-399C	43,000 ± 3300 41,050 BC	"	Sangoan	Wood	3
6. L-399B	> 42,500	"	"	"	"
7. GrN-3237	42,000 ± 2000 40,050 BC	"	?Middle to Lower Sangoan	"	1
8. L-399A	> 40,000	"	Sangoan	"	3
9. GrN-3196	40,600 ± 1300 38,650 BC	"	Later Sangoan	Charcoal	1
10. GrN-3228	37,900 $^{+1500}_{-1200}$ 35,950 BC	"	Probably Sangoan	Wood	"
11. L-271A	> 35,000	"	Acheulian	"	2
12. GrN-3608	> 32,600	"	Sangoan	Charcoal	1
13. SR-7	> 42,200	Pomongwe, Rhodesia	Sangoan	"	9
14. SR-8	42,200 ± 2300 40,300 BC	"	Proto-Stillbay	"	"

c. EAST AFRICA

No Carbon-14 dates. See Cole, S. 1964. **The Prehistory of East Africa.** George Weidenfeld & Nicholson. 117-126 for Potassium - Argon dates and their associations at Olduvai Gorge. Also Leakey, L.S.B., Evernden, J.F. & Curtis, G.H. 1961. The Age of Bed I, Olduvai Gorge, Tanganyika. **Nature 191,** 478.

d. WEST AFRICA

Lab. No.	Date	Site	Associations	Sample	Reference
15. Y-142-8	> 39,000	Nok, Nigeria	Acheulian	Carbonized wood	7

ADDITIONAL NOTES ON EARLY STONE AGE AND FIRST INTERMEDIATE DATES

Kalambo Falls:

Kalambo Falls are at the south eastern end of Lake Tanganyika on the territorial boundary between Northern Rhodesia and Tanganyika. In a small basin above the falls are three main series of sediments forming three terrace features at ca. 20m, 10m, and ca. 5m above the river. These contain a nearly continuous cultural sequence from the end of the Earlier Stone Age (Late Acheulian) up to the present day. Excavations have been carried out since 1953 by J.D. Clark of Rhodes-Livingstone Museum, now of the Dept. Anthropology, University of California, Berkeley, and have exposed a series of well-stratified living floors, stream, lake and swamp sediments, and erosion surfaces with a wealth of associated cultural remains (Clark, 4, 5, 6). Oldest surfaces and floors contain wooden as well as stone artifacts and evidence of fire-using. E.M. van Zinderen Bakker was able to detect in the pollen climatic variations which represent a pre-Gamblian wet period (Late Kanjeran), the Gamblian, and the Holocene. C14 dates indicate that the time span involved is from early Wurm onwards. (See refs. 1, 2, 3, 4, 5, 6, 10, 11).

1, 2 **GrN-2644, GrN-1396. Kalambo Falls /57.** 57,600 ± 750
55,650 BC

A log of well-preserved wood from Floor 6 at > 52,000
site A 1, 6.7m below surface, and associated with a late Acheulian industry (handaxes, cleavers and flake tools) which preceded the Sangoan at this site. **Comment**: C14 in sample GrN-2644 was enriched by a factor of 8.7 before measurement, and the finite date was obtained, while sample GrN-1396 was from the same log but was not enriched. (1)

3. **GrN-3211. Kalambo Falls 26/59R** > 49,000

Wood immediately over lower clay layers and from lowest Sangoan level in trench A4. **Comment**: Date appears old for Sangoan and it is possible that wood might have been derived from clays on which it was lying and which in the 1963 excavations at Site A were associated with a transitional Acheulian-Sangoan industry. (1)

4. **GrN-3226. Kalambo Falls 16/59R** $46{,}100\,^{+3500}_{-2400}$
44,150 BC

Small sample of charcoal below clay bank in fine white sand in Trench A4, representing the later stages of the typical Sangoan. (1)

5. **L-399C Kalambo Falls** 43,000 ± 3300
41,050 BC

Wood from beneath the third occupation floor i.e. under the Middle Stone Age occupation and over the Early Stone Age layers at Site A. Sample comes from the roots of a tree that apparently grew on a land surface developed on the lower levels of the Early Stone Age beds after the upper levels had been removed by erosion. The tree was then buried by material upon which the third or Middle Stone Age floor developed. The sample is believed to date the time of the Sangoan culture. Laboratory recommends that this date be used in a conservative manner due to methods used in counting. (3)

6. **L-399B. Kalambo Falls** > 42,500

Wood from the fourth occupation floor at Site B. Associated cultural material was sparse but sufficient (in the form of picks) to be sure that it is post-Chelles-Acheul and belongs with the Sangoan. (3)

7. **GrN-3237. Kalambo Falls 8/59R** 42,000 ± 2000
40,050 BC

Wood fragments in sterile lower coarse sand 2.3m under main (Middle Stone Age) erosion surface at site B2. Sangoan artifacts (middle to lower stages?) occur sporadically in gravel stringers at this depth. (1)

8. **L-399A. Kalambo Falls** > 40,000

Wood from a clay-filled gully cut in current-bedded sands and believed to be of approximately the same age as samples L-399B and L-399C. (3)

9. **GrN-3196. Kalambo Falls 11/59R** 40,600 ± 1300
38,650 BC

Charcoal flecks and small fragments in gray sand 15cm below main (Middle Stone Age) stone line in Trench A4 representing later stages of typical Sangoan Culture. Pollen evidence indicates climate was cooler and wetter than in the immediately following stages. (1)

10. **GrN-3228. Kalambo Falls 5/59R** $37,900 ^{+1500}_{-1200}$
35,950 BC

Small sample of wood in coarse sand 1.5m under main (Middle Stone Age) stone line and over gravel stringer containing Sangoan waste. Since Sangoan sediments are characterized by much cutting and filling and culture is conservative, it is difficult to correlate the succession on the different sites. (1)

11. **L-271A. Kalambo Falls** > 35,000

Wood from a tree trunk found in Lower Palaeolithic site, later (3) referred to as being from Floor 5 (Acheulian). (2)

12. **GrN-3608. Kalambo Falls 18/59R** > 32,600

Small sample of charcoals 4m below clay bank in Trench A4 from dark grey clay containing Sangoan artifacts. (1)

13. **SR-7. Pomongwe, Rhodesia** > 42,200

Pomongwe Cave in the Matopos Hills was excavated during 1960-1961 by C.K. Cooke, Director of the Historical Monuments Commission in Rhodesia. Geographical position: 20° 32'S Lat., 28° 30'E Long.

For sample SR-7, an exceptionally small charcoal sample had to be counted at reduced pressure. The cultural affinities are probably Sangoan. (8, 9)

14. **SR-8. Pomongwe, Rhodesia** 42,200 ± 2300 / 40,300 BC

Combination of two charcoal samples. **Comment**: mixing was necessary because of the small amount of charcoal in the deposit. Stratigraphically the samples were one below the other but culturally the same, being the nexus between the Sangoan of the 1st Intermediate Stone Age and the Still Bay of the Middle Stone Age. In his report on the excavations, Cooke (1963) refers to this sample as dating the Proto-Stillbay. (8, 9)

Note: The B. C. date given above and in the table is that published by the laboratory and is not consistent with general practise of subtracting 1950 from the B. P. date. A corrected figure would read 40,250 B. C.

15. **Y-142-8. Nok, Nigeria.** > 39,000

Carbonized wood from Nok E, the oldest alluvium, and associated with Acheulian artefacts. Collected by Bernard Fagg. (7)

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II. MIDDLE STONE AGE AND SECOND INTERMEDIATE

a. SOUTH AFRICA

	Lab. No.	Date B.P. / B.C.	Site	Associations	Sample	Reference
1.	Y-103	> 44,000	Florisbad, Orange Free State	Peat I. Level of Florisbad skull	Peat	3
2.	C-850	> 41,000	"	"	"	2
3.	L-271B	> 35,000	"	"	"	1
4.	L-271C	28,450 ± 2200 26,500 BC	"	Peat II. Middle Stone Age	"	"
5.	L-271D	19,530 ± 650 17,580 BC	"	Peat III. Middle Stone Age	"	"
?* 6.	C-851	9104 ± 420 7154 BC	"	Peat II. Middle Stone Age	"	2
?* 7.	C-852	6700 ± 500 4750 BC	"	Peat III. Middle Stone Age	"	"
? 8.	BM-39	> 25,000	Olieboompoort, Transvaal	Middle Stone Age, Pietersburg variant	?Charcoal or decayed wood	4
* 9.	C-926	16,811 ± 960 14,861 BC	Cave of Hearths, Transvaal	Earlier Pietersburg	Organic material	2
*10.	C-927	11,700 ± 610 9,750 BC	"	"	"	"
*11.	C-924	11,600 ± 700 9,650 BC	"	Middle Pietersburg	"	"
*12.	C-925	15,100 ± 730 13,150 BC	"	Later Pietersburg	"	"
13.	BM-30	18,200 ± 500 16,250 BC	Holley Shelter Natal	Middle Stone Age from 24"-30"	Charcoal	4
14.	BM-34	4,490 ± 150 2,540 BC	"	" from 18"-24"	"	"

b. CENTRAL AFRICA

15.	UCLA-168	38,000 ± 2500 36,050 BC	Mufo Mine, Angola	Sangoan/Lower Lupemban	Peat	7
16.	UCLA-169	> 34,000	"	"	Wood	"
17.	C-581	14,503 ± 560 12,553 BC	"	Later Upper Lupemban or Lupemban-Tshitolian	Carbonized Wood	8
18.	C-580	11,189 ± 490 9,239 BC	Mufo Mine, Angola	Lupembo-Tshitolian or Lower Tshitolian	Carbonized Wood	8
19.	SR-9	42,200 ± 2300 40,250 BC	Pomongwe, Rhodesia	Early Stillbay or ?Proto-Stillbay	Charcoal	9
20.	SR-39	35,530 ± 780 33,580 BC	"	Stillbay or ?Proto-Stillbay	"	"
21.	SR-10	21,700 ± 400 19,750 BC	"	Stillbay	"	"
22.	SR-11	15,800 ± 200 13,850 BC	"	Magosian	"	"

b. CENTRAL AFRICA (cont.)

	Lab. No.	Date B.P./B.C.	Site	Associations	Sample	Reference
23.	Lv-44	> 30,000	Lemba, Congo	Below Late Lupemban level	Fossilized Wood	6
24.	Lv-47	> 30,000	Basoko R. Congo	Lupemban	Charcoal	"
25.	L-399 I	30,500 ± 2000 28,550 BC 27,500 ± 2300 25,550 BC	Kalambo Falls, Zambia	Rhodesian Lupemban	"	5
26.	UCLA-229	22,800 ± 1000 20,850 BC	Twin Rivers, Zambia	Middle Stone Age	Travertine	10
27.	L-395 D	9,550 ± 210 7,600 BC	Abercorn, Zambia	Rhodesian Magosian	Charcoal	5
c.	EAST AFRICA					
28.	NPL-38	$31{,}480^{+1640}_{-1350}$ 29,530 BC	Kisese, Tanzania	2nd Intermediate	Charred Ostrich eggshell	29
d.	WEST AFRICA					
29.	Y-142-3	5575 ± 65 3625 BC	Nok C Nigeria	Middle Stone Age	Wood	3
30.	Y-142-7	5440 ± 110 3490 BC	Zenebi Nigeria	" " "	"	"

ADDITIONAL NOTES ON MIDDLE STONE AGE AND SECOND INTERMEDIATE DATES

Florisbad series, Orange Free State, South Africa:

Florisbad (28° 40'S; 26° 10'E) lies approximately 25 - 30 miles north of Bloemfontein. The stratification is marked with four so-called peaty layers separated by lighter bands of sand and clays. The dark layers are composed of blackish clays and sands with little organic matter (16).

Peat I: lies immediately over bedrock at a depth of 19 ft. and from it were recovered the Florisbad skull, **Homo** or **Africanthropus helmei**, in association with stone implements made on dolerite and extinct fauna including **Homoioceras baini** and **Equus helmei**.

Peat II: 47 ins. above Peat I and 13 ins. thick. Cultural material in lydianite is Middle Stone Age.

Peat III: 52 ins. above Peat II. Similar cultural material.

Peat IV: 23 ins. below the top layer of light grey sand.

The cultural affinities of the dolerite implements from Peat I are not very clear. Meiring (11) has suggested they be known as the Florisbad Chopper Culture, while Oakley (12) and others have referred to the assemblage as the Hagenstadt variant of the Middle Stone Age. The cultural material from the other levels (in lydianite) is generally accepted as being Middle Stone Age of the Mazelspoort variant (13, 14, 15). Part of a wooden implement has been recovered from Peat 1 (13). Van Zinderen Bakker (16) has examined the deposits for pollens, but these have not been preserved at all levels and the evidence is incomplete.

Van Zinderen Bakker (16) has suggested that methane gas and underlying Ecca coal seams may be responsible for contaminating the peat used for dating samples and giving erroneously old dates, a view supported by Coon (17). However, contamination by old carbon produces a less significant error in an already old sample than [illegible]. Zeuner (18) shows that with a sample of the age of 37,000 years old, as much as 100 per cent old or inactive carbon would have to be added to make the date 5000 years older.

Note: After measurements C-581 and C-582 were made, the samples were found to have been contaminated with modern tree roots (11) and additional samples L-271C and L-271D were therefore submitted.

1. **Y-103. Florisbad Peat I** > 44,000

Peat collected in 1951 and submitted by E. M. van Zinderen Bakker (3).

2. **C-850. Florisbad Peat I** > 41,000

Peat submitted by H. L. Movius Jr. on behalf of A. C. Hoffman, National Museum, Bloemfontein. (2)

3. **L-271B. Florisbad Peat I** > 35,000

Peat submitted by H. L. Movius Jr. on behalf of A. C. Hoffman, Bloemfontein. (1)

4. **L-271C. Florisbad Peat II** 28,450 ± 2200
26,500 BC

Peat from same level as sample C-851, but cleaned to remove modern tree rootlets. Submitted by H. L. Movius Jr. on behalf of A. C. Hoffman, Bloemfontein. (1)

5. **L-271D. Florisbad Peat III** 19,530 ± 650
17,580 BC

Peat from same level as C-852, but pretreated to remove modern tree rootlets. Submitted as above. (1)

6. **C-851. Florisbad Peat II** 9104 ± 420
7154 BC

This sample is unreliable as it was later found to have been contaminated with younger carbon. Submitted as above. (2)

7. **C-852. Florisbad Peat III** 6700 ± 500
4750 BC

Sample unreliable due to contamination by younger carbon. Submitted as above. (2)

8. **BM-39. Olieboompoort, Transvaal** > 25,000

The cave is on the west side of Olieboompoort, north-west of Waterberg in the Transvaal (23° 50'S; 27° 40'E) between Ellisras and Vaalwater villages. The sample of heavily mineralized material submitted for dating was recovered from Bed 2 in association with implements of the latter part of the Pietersburg Culture middle stage. Bed 2 overlies an Earlier Stone Age level (19) and underlies a Later Stone Age level of Later Smithfield type.

The sample of material submitted for dating occurred in nodules scattered between 36 in. and 54 in. below the present surface and therefore do not appear to represent a fireplace. The sample closely resembled charcoal, but nothing remained after treatment with hot 1% hydrochloric acid and hot 1% caustic soda. Accordingly, the caustic-soda-soluble fraction was reprecipitated with acid, washed and dried, and used as the source of carbon. Under these circumstances one cannot rule out the possibility of contamination (4). Collected during excavation by Dr. R. J. Mason. (See also (20)).

Note: This date has frequently been quoted as > 33,000 (19). The date published by the laboratory has been taken as the correct one.

Cave of Hearths, Transvaal.

The Cave of Hearths in the Makapansgat Valley near Potgietersrus in the Transvaal has revealed a long sequence of cultures associated with faunal material. Mason (19) has published the following succession from the excavated deposit which is some 40 ft. deep.

Beds 1-3: Earlier Stone Age, Acheulian culture
Bed 4: Middle Stone Age, Earlier Pietersburg culture
Bed 5: Middle Stone Age, Middle Pietersburg culture

Beds 6-9: Middle Stone Age, Later Pietersburg
Bed 10: Later Stone Age, Smithfield culture
Bed 11: Iron Age.

Anomalies in the following dates are difficult to explain and may be due to a variety of sources of contamination. Mason (19) states that one of the dates (C-927) comes from a subsided part of Bed 4, but its radiocarbon age is 5,000 years less than the **in situ** part of the same bed, while the Bed 5 date (C-924) is also about 5,000 years less than the Bed 6 date.

By statistical analysis of the Pietersburg cultural material from the Cave of Hearths, Mason (20) has been able to correlate other sites in the Transvaal with this sequence.

9. **C-926. Cave of Hearths, Bed 4** — 16,811 ± 960 / 14,861 BC

Pietersburg culture Earlier stage from 156 ins. depth in Column "A". Organic material from the ashy substance constituting the deposit in the cave. (2)

10. **C-927. Cave of Hearths, Bed 4** — 11,700 ± 610 / 9,750 BC

Earlier Pietersburg cultural stage. Sample same material as above, from 288 ins. depth in column "C". (2)

11. **C-924. Cave of Hearths**, Bed 5 — 11,600 ± 700 / 9,650 BC

Middle Pietersburg cultural stage. Sample same material as above, from 130 ins. depth in column "A".

12. **C-925. Cave of Hearths, Bed 6** — 15,100 ± 730 / 13,150 BC

Later Pietersburg cultural stage. Sample same material as above from 180 ins. depth in column "B".

All samples collected by R. J. Mason and submitted by K. P. Oakley, British Museum, London.

Holley Shelter series, Wartburg, Natal

Two samples of charcoal from a rock shelter on the farm "Everdon" at Wartburg (29° 26'S; 30° 35'E), excavated by G. Cramb. The charcoal was collected from hearths which were quite close to each other both horizontally and vertically, the grids being 3 ft. square. The Middle Stone Age material is homogenous throughout and is overlain by Later Stone Age and Iron Age material in the top 6 ins. of deposit.

The close proximity of the samples makes the difference in their ages seem extraordinarily high. However, the excavator has pointed out that the situation of the cave is such that the build-up of the floor level may have been extremely slow. The value for BM-30 is not inconsistent with the Cave of Hearths Middle Stone Age date of 15,100 ± 730 (C-925). On the other hand, BM-34 is much too young by comparison and one must assume that either the sample is suspect or that the Middle Stone Age people lived uninterruptedly in these parts to a period more recent than has been thought. (4, 21)

13. **BM-30. Holley Shelter I** 18,200 ± 500
16,250 BC

Charcoal from the 24 - 30 ins. layer in Grid Z3.

14. **BM-34. Holley Shelter II** 4,490 ± 150
2,540 BC

Charcoal from the 18 - 24 ins. layer in Grid Z2.

Collected by G. Cramb, Durban, and submitted by the Director, Archaeological Survey.

Mufo Mine series, Lunda, Angola

Pleistocene deposits at Mufo, Angola, on the banks of the Luembe river (7° 38'S; 21° 24'E) have yielded a succession of cultural material ranging from Earlier Stone Age on the ± 10m terrace, through Middle Stone Age Lupemban in the lower gravels of the ± 3m terrace and Lupembo-Tshitolian in the upper gravels of the same terrace. Later Stone Age Tshitolian implements occur either on top of the upper gravels or within the Redistributed Sands III which overlie the terrace. The deposits have been studied by Janmart (23), Leakey (24) and Clark (22).

There has been some change in the terminology used in this area in the past, and in 1957 Mortelmans (25) clearly defined and illustrated the industries and cultural terms for the region, and his terminology has been adopted by Clark (22, 26) and others.

15. **UCLA-168. Mufo Mine, Angola** 38,000 ± 2500
36,050 BC

Peat from the sand layer in the Lower Flats Gravel of the Flats Terrace at a depth of 10 ft. (7), and 3' 6" below the top of the Lower Gravels of the 3-4m terrace (22). Middle Stone Age, Lower Lupemban culture (7), or Sangoan Lower Lupemban (22). Collected 1960 and submitted by J.D. Clark, Berkeley, California.

16. **UCLA-169. Mufo Mine, Angola** > 34,000

Wood from the sand layer near the base of the Lower Flats Gravel of the Flats Terrace at a depth of 15 ft. (7), and 3' 6" below the top of the Lower Gravels of the 3-4m Terrace (22). Lower Lupemban (7), or Sangoan Lower Lupemban (22). Submitted as above.

17. **C-581. Mufo Mine, Angola** 14,503 ± 560
12,553 BC

Carbonized wood found 15cm down in the gravel underlying sample C-580 (8), and from the top-most 50cm of the Upper Gravels of the 3-4m Terrace (22). Submitted by J. Janmart, Museu do Dundo, Angola (8).
Classified by Clark (26) as Later Lupemban (originally called Final Sangoan by Janmart and Leakey) and later as Late Upper Lupemban or Lupembo-Tshitolian (22).

18. **C-580. Mufo Mine, Angola** 11,189 ± 490
9,239 BC

Carbonized wood at the base of 2.50m of grey-white sand (=Redistributed Sand III of Clark (22)), associated with a Lupemban (=Tshitolian of Mortelmans and Clark) backed blade (8), and from a land surface on the Upper Gravels of the 3-4m Terrace (22). The sample is placed uncertainly in this part of the list. Referred to by Janmart as Lupemban (=Tshitolian), it was later placed in the "forest form of the Magosian" (=Lupembo-Tshitolian) by Clark (26), and then in the Lupembo-Tshitolian or Lower Tshitolian by Clark (22). It may therefore be Later Stone Age.

Pomongwe series, Rhodesia

Pomongwe cave in the Matopo Hills (20° 32'S; 28° 30'E) near Bulawayo was excavated during 1960/61 by C.K. Cooke, Director of the Commission for the Preservation of Natural and Historical Monuments and Relics (9). In 13 ft. 5 in. of deposit, the following cultural succession was recognized: Sangoan or Proto Stillbay, Stillbay, Magosian, an unusual scraper industry in a white ash layer, Wilton and Iron Age (Bambata ware) (27). Excavation of Tshangula cave nearby revealed a similar sequence.

19. **SR-9. Pomongwe cave, Rhodesia** 42,200 ± 2300
40,300 BC

Charcoal from small logs from hearths associated with the earliest levels of the Stillbay industry (9), from layer 6b E-g 6-8, at a depth of 8 ft. 3 in. and at the contact of the lower cave earth (27). Owing to the early date for this sample and the 20,000 year hiatus between this and the developed stage of the Stillbay (SR-10), Cooke considers that this may be ?Proto-Stillbay (27).

Note: The BC date above is that published by the laboratory but it is not consistent with the practise of subtracting 1950 years from the BP date. A corrected figure would read 40,250 BC. See also the Early Stone Age list, date no. 13 and 14.

20. **SR-39. Pomongwe cave, Rhodesia** 35,530 ± 780
33,580 BC

Charcoal associated with the Stillbay industry (9). From layer 13, 5(2A) X-C 1-3 at a depth of 7 ft. 6 in. and above the lower cave earth (27). Possibly of similar age to the above sample and also ?Proto-Stillbay.

21. **SR-10. Pomongwe, Rhodesia** 21,700 ± 400
19,750 BC

Charcoal associated with the developing Middle Stone Age Stillbay industry. The error is larger than usual because the sample was small and was counted at reduced pressure (9). From layer 5c E-G 6-8, and at a depth of 6 ft. 6 in.

22. **SR-11. Pomongwe, Rhodesia** 15,800 ± 200
13,850 BC

Charcoal associated with the Second Intermediate Magosian industry (9).

From layer 4b I-K 6-8 at a depth of 3 ft. 9 in. (27). Cooke (27) considers that this unexpectedly early date "may well indicate that the introduction of the microlith at this time was a spontaneous local invention and not an industry which was introduced by immigrant bands of Later Stone Age nomadic hunters from elsewhere."

Leopoldville series, Congo

Samples related to stone age industries in the Leopoldville plain. Collected by H. V. Moorsel, Prehistorical Museum, Leopoldville, Congo, and submitted by F. Gullentops, University of Louvain, Belgium (6). The deposits have been compared with those from Angola by Clark (22a).

23. **Lv-44. Lemba, Congo** > 30,000

Fossil wood from Lemba (4° 23'S; 15° 20'E) in peaty sandstone, the surface of which has a late Lupemban culture. Sandstone is covered by sand which has a Tshitolian culture (6). This sample therefore pre-dates the late Lupemban in this area.

24. **Lv-47. Basoko River, Congo** > 30,000

Charcoal from a site near the Basoko river on the Leopoldville plain (4° 21'S, 15° 17'E). The sample is from a Lupemban horizon (intermediate zone) overlain by clayey silt and 30 cm above polymorphous sandstone blocks (6).

25. **L-399 I. Kalambo Falls, Zambia** 30,500 ± 2000 [1] 27,500 ± 2300 [2]
28,550 BC 25,550 BC

Charcoal from the earlier of two Middle Stone Age floors (Rhodesian Lupemban) in old lake beds adjacent to the falls, near the southern end of Lake Tanganyika. Collected by J. D. Clark, submitted by H. L. Movius Jr., (5) see also Early Stone Age list nos. 1-12.

[1] Residue after humic acid removal.

[2] Humic acid.

26. **UCLA-229. Twin Rivers, Zambia** 22,800 ± 1000
20,850 BC

Travertine from a breccia-filled fissure, Twin Rivers (15° 31'S: 28° 11'E). The fissures, some 5 to 6 ft. deep, occur on top of the Twin Rivers kopje and contain a Middle Stone Age industry and fauna. The Travertine is believed to have been formed as a result of the seepage of water down the slopes of the fissures during a cooler and wetter climate. The travertine sample dated was about 1 m. thick with a thin brown layer through the centre. The bottom and top halves of the sample were therefore dated and an average of the two calculated. The age of the top layer was 23,700 ± 1000 years, and that of the bottom layer 21,900 ± 1000 years thus it appears that the C14 exchange subsequent to deposition has not been significant. Collected in 1956 and submitted by J. D. Clark (10). The industry is possibly Proto-Stillbay (26).

27. **L-395 D. Abercorn, Zambia** 9550 ± 210
7600 BC

Charcoal from a temporary land surface near the base of a sequence of current-bedded sands (8° 35'S, 31° 13'E). The sample should date the Rhodesian Magosian culture. Collected by J.D. Clark (5).

28. **NPL-38. Kisese II Rock shelter, Tanzania** $31{,}480\,^{+\,1640}_{-\,1350}$
29,530 BC

Charred ostrich eggshell was used to date this sample from the middle part of the Second Intermediate level in Kisese II Rock shelter (4° 25' 15" S; 35° 50'E) in the Kondoa district of Tanzania. However, in view of the careful pretreatment given the samples, the suitability of ostrich eggshell for dating requires investigation (29). See Later Stone Age list nos. 38-40 for further dates and information.

29. **Y-142-3. Nok C, Nigeria** 5575 ± 65
3625 BC

Wood from alluvium exposed in the Main Paddock of a tin mine on the Nok River near Jos. The oldest alluvium contains Acheulian artefacts, the next oldest (this sample) contains Middle Stone Age, and the basal gravel of the youngest alluvium contains pottery and terra-cotta figurines and some evidence of metal working. The sample was measured twice to insure against mixture of samples and the above date is the average of two tests: sample Y-142-4 was dated at 5490 ± 85 BP, and another portion of the same piece of wood, Y-142-3', was dated at 5660 ± 90 (3). See also the Early Stone Age list no. 15, and Iron Age list no. 52-54. Bond (28) has investigated the geological deposits.

30. **Y-142-7. Zenebi, Nigeria** 5440 ± 110
3490 BC

Wood from a large log imbedded in the older tin-bearing alluvium in Zenebi No. 1 Paddock on the Zenebi River, near Jos. Associated with a Middle Stone Age industry, it supports the date of no. 29 above. Collected in 1948 by B. Fagg and G. Bond (3).

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III. LATER STONE AGE

a. SOUTH AFRICA

	Lab. No.	Date B.P. / B.C.	Site	Associations	Sample	Reference
1.	L-336H	11,250 ± 400 9300 BC	Matjes River, Cape	Layer D. Smithfield A	? Charcoal	16
1a	L-336G	10,500 ± 400 8550 BC	"	"	"	"
2.	L-336E	7750 ± 300 5800 BC	"	Layer C. Wilton	"	"
3.	L-336F	5400 ± 250 3450 BC	"	"	"	"
4.	SR-34	5200 ± 140 3250 BC	Windhoek, South West Africa	Quartz industry	Elephant tusk	10
* 5.	C-911	3368 ± 200 1418 BC	Philip Cave, South West Africa	Smithfield/ Wilton	Charcoal	3
6.	R-23	280 ± 80 AD 1670	"	Surface of cave deposit	"	14
7.	BM-31	1020 ± 150 AD 930	Magabengberg, Transvaal	Later Smithfield	"	5
8.	BM-42	870 ± 150 AD 1080	Olieboompoort, Transvaal	"	Charred bone	"

b. CENTRAL AFRICA

	Lab. No.	Date B.P. / B.C.	Site	Associations	Sample	Reference
9.	UCLA-629	12,200 ± 250 10,250 BC	Tshangula Cave, Rhodesia	Lower Wilton: Scraper industry	Charcoal	15
10.	UCLA-172	12,970 ± 250 11,020 BC	Calunda 3, Angola	Lower Tshitolian	"	8
?11.	Y-808 c.r.	10,820 ± 340 8870 BC	Kasama Cave, Zambia	Nachikufan II	"	6
	a.s.f.	11,700 ± 280 9750 BC				
?12.	Y-620B	9720 ± 550 7770 BC	Nachikufu Cave, Zambia	"	"	"
?13.	Y-625	8640 ± 240 6690 BC	Kasama Cave, Zambia	"	"	"
?14.	Y-805 c.r.	7320 ± 200 5370 BC	Kasama Cave, Zambia	Nachikufan II or III	Charcoal	6
	a.s.f.	7200 ± 200 5250 BC				
?15.	Y-623 c.r. -624	3460 ± 200 1510 BC	Nachikufu Cave, Zambia	Nachikufan I	"	"
	a.s.f.	7540 ± 600 5590 BC				
?16.	Y-791	5630 ± 200 3680 BC	"	Nachikufan II	"	"
?17.	Y-619	5000 ± 200 3050 BC	"	Nachikufan III	"	"

b. CENTRAL AFRICA (cont.)

	Lab. No.	Date B.P. B.C.	Site	Associations	Sample	Reference
	Y-619 bis	4830 ± 320 2880 BC	Nachikufu Cave, Zambia	Nachikufan III	Charcoal	6
?18.	Y-799	1060 ± 100 AD 890	"	Nachikufan II	"	"
19.	SR-12	9400 ± 100 7450 BC	Pomongwe Cave, Rhodesia	Scraper industry in white ash layer	"	10
?20.	SR-13	7690 ± 140 5740 BC	"	"	White ash	"
21.	SR-14	7610 ± 110 5660 BC	"	Wilton	Ash	"
?22.	W-283	21,000 ± 500 19,050 BC	Ishango, Congo	Crude quartz industry with bone harpoons	Shell	1
	W-284	3000 ± 200 1050 BC	"	Modern shell	"	"
23.	UCLA-167	6830 ± 120 4880 BC	Mufo Mine Angola	Early Tshitolian	Wood	8
24.	UCLA-171	4700 ± 100 2750 BC	Calunda 3 Mine Angola	Late Tshitolian	"	"
25.	UCLA-170	1800 ± 80 AD 150	Furi I Mine Angola	"	"	"
*26.	C-663	6310 ± 250 4360 BC	Chifubwa Stream, Zambia	Nachikufan I	Charcoal	2
27.	Lv-45	6030 ± 190 4080 BC	Mt. Gafula, Congo	Late Tshitolian	"	7
28.	UCLA-174	4700 ± 100 2750 BC	Lochinvar Mound, Zambia	Wilton	Wood	8
29.	UCLA-173	4300 ± 100 2350 BC	"	"	Charcoal	8
30.	M-1324	4650 ± 150 2700 BC	"	"	"	12
31.	M-1323	4450 ± 150 2500 BC	"	"	"	"
32.	Not published	4785 ± 70 2835 BC	Lochinvar, Gwisho 'B' site, Zambia	"	Not published	17
33.	"	3680 ± 70 1730 BC	"	"	"	"
34.	"	3660 ± 70 1710 BC	"	"	"	"
35.	BM-57	4200 ± 150 2250 BC	Amadzimba cave Rhodesia	Lower Wilton	Carbonized bone & wood ash	4
*36.	C-830	2139 ± 150 189 BC	Lusu Village, Zambia	Late Wilton	Charcoal	3
37.	SR-15	1220 ± 100 AD 730	Dombozanga cave Rhodesia	Wilton	"	10

c. EAST AFRICA

	Lab No.	Date B. P. B. C.	Site	Associations	Sample	Reference
?38.	NPL-37	18,190 ± 306 16,240 BC	Kisese rock shelter, Tanzania	Second Intermediate/ Later Stone Age transition	Charred Ostrich eggshell	13
?39.	NPL-35	14,760 ± 202 12,810 BC	"	Middle part of Later Stone Age	"	"
?40.	NPL-36	10,720 ± 132 8770 BC	"	Early Later Stone Age	"	"
41.	Y-91	2920 ± 80 970 BC	Njoro River cave, Kenya	Elmenteitan with stone bowls	Charcoal	9

ADDITIONAL NOTES ON LATER STONE AGE SITES

Matjes River series, South Africa

The Matjes River rock shelter is situated at the mouth of the Matjes River (34° 01'S. 23° 25'E) near Plettenberg Bay in the south Cape coastal region. Originally excavated by Dreyer in 1929 (20), the deposit was re-excavated between 1952 and 1958 by Dr. A.C. Hoffman, Dr. A.J.D. Meiring and Dr. J.T. Louw of the National Museum, Bloemfontein. The deposit is composed mainly of some 34 ft. of shell midden debris in which several Later Stone Age horizons have been distinguished, together with human skeletal material and faunal remains. Louw (16) has recognised the following succession:

Layer E (at the base) : An indeterminable quartzite flake industry associated with rolled pebbles and ash.

Layer D : Smithfield A cultural material with re-used Middle Stone Age points, associated with extant species of antelope, **Donax** shells and human skeletal remains.

Layer C . Wilton cultural material without pottery, associated with the same faunal material as above, and with human skeletal remains closely resembling those from Oakhurst (19); one burial was covered with a painted burial stone (18).

Layer B : Smithfield B cultural material, associated with blue mussel shells, fewer antelope than were present in Layers C and D and 'Proto-Bushman' remains.

Layer A : Smithfield B cultural material (Strandlooper variant of Louw), associated with remains of small antelope and **Donax** shells.

The dates are internally consistent although somewhat older than would be expected by comparison with other Later Stone Age dates from South Africa and other dates from similar shelters are needed to confirm their age. It is also interesting to note that the cultural succession here is different from the nearby Oakhurst shelter (Cooke et al., 22) where the Smithfield B was overlain by Smithfield C and the Wilton levels were at the top of the deposit.
See also Clark (21) for further comments.

1. **L-336H. Matjes River, Cape** 11,250 ± 400
9300 BC

Presumably charcoal (details of material submitted not published) from Layer D, Smithfield A cultural level (16).

1a. **L-336G. Matjes River, Cape** 10,500 ± 400
8550 BC

?Charcoal from Layer D, Smithfield A cultural level (16).

2. **L-336E. Matjes River, Cape** 7750 ± 300
5800 BC

?Charcoal from Layer C, Wilton cultural level (16).

3. **L-336F. Matjes River, Cape** 5400 ± 250
3450 BC

Sample from Layer C; Wilton cultural material (16).

4. **SR-34. Zoo Park Gardens, Kaiserstrasse, Windhoek** 5200 ± 140
3250 BC

A large piece of elephant tusk from the Zoo Park Gardens (22° 55'S; 17° 05'E). The remains of an elephant were associated with a quartz stone industry, analysis of which may prove important in relating the stone industry to a specific industrial activity. Collected by R. MacCalman, State Museum Windhoek. (10).

5. **C-911. Philip Cave, South West Africa** 3368 ± 200
1418 BC

Charcoal from Philip Cave (Ameib) south east of the Erongo mountains in South West Africa (ca. 22° 00'S, 16° 20'E), found stratified in the deposit in direct association with ochre for making the paintings which cover the cave walls (3). The date has been accepted by H. Breuil (23) as an indication of the age of the principal cycle of paintings in the cave. Clark (21) states that the sample came from the middle levels of the cave deposit and is associated with a Smithfield/ Wilton industry.

6. **R-23. Philip Cave, South West Africa** 280 ± 80
AD 1670

Charcoal fragments 2 to 3 cm in diameter found on the surface of the deposit in the same cave as above; submitted in 1952 by the late H. Breuil. **Comment** (14): owing probably to a spring that in the past had deposited calcareous tufa, this charcoal was so strongly lithified by $CaCO_3$ that the fragments had to be reduced to a fine powder before the carbonate could be wholly eliminated by repeated treatment with 10% HCL. The age shows that the sample is fairly recent and thus sample C-911 was believed by the Abbe Breuil to date the paintings (14).

7. **BM-31. Magabengberg, Transvaal** 1020 ± 150
AD 930

Charcoal from Bed 1 in Magabengberg Cave (23° 15'S; 28° 55'E), Northern Transvaal, and found in association with a Later Smithfield industry. Excavated in 1954 by Jean Humphries (5), and discussed in detail by Mason (24).

8. **BM-42. Olieboompoort Cave, Transvaal** 870 ± 150
AD 1080

Charred bone from Bed 3, Olieboompoort cave (23° 50'S; 27° 40'E) in the Waterberg, western Transvaal, and found in association with a Later Smithfield industry. Excavated in 1954 by R.J. Mason (5). Mason (24) has made statistical comparisons between this industry and that from Magabengberg.

9. **UCLA-629. Tshangula cave, Rhodesia** 12,200 ± 250
10,250 BC

Charcoal from the bottom of the Wilton layer in Tshangula cave, Rhodesia

(20° 25'S; 28° 35'E), and overlying a white ash layer with an unusual scraper industry (25). Excavated in 1963 as a check against the earlier excavation of Pomongwe cave by C.K. Cooke (15). **Comment** (15): the result is older than expected in view of the date of 9400 ± 100 (this list, No. 21) for the same cultural level at Pomongwe. It could be consistent, however, if the sample came from the consolidated white ash floor and was covered by ash of the later occupation. For further dates from Pomongwe, see the Middle Stone Age list Nos. 19-22, and this list Nos. 19-21.

10. UCLA-172. Calunda 3 mine, Angola 12,970 ± 250
11,020 BC

Charcoal from the lower part of the Redistributed Sands over the lower stream gravel (8), and dating the Lower-Tshitolian culture, (25). For other dates from the same series, see the Middle Stone Age list Nos. 15-18, and this list Nos. 23, 26, 27.

Kasama and Nachikufu series, Zambia

Charcoal from various cultural levels at Nachikufu cave (12° 14'S; 31° 15'E) near Mpika in Zambia, the type site of the Nachikufan Later Stone Age culture, and at the related rock-shelter site of Kasama (10° 13'S; 31° 12'E). Excavations at Nachikufu in 1953 by J. Desmond Clark, and at Nachikufu and Kasama in 1955 by Mrs. L. Hodges (6). **Comment** (6): Except for Y-791, all samples were pre-treated with alkali as usual. Samples believed to be bone charcoal (Y-805, Y-808, Y-623-624) were divided during pretreatment, and the alkali-soluble material was dated separately. Normally, as found by the Groningen Laboratory, the alkali-soluble fraction is at least slightly older, and, as the removal of soluble material is not 100% complete, doubt is thrown on both measurements. This series of dates, though reasonably consistent internally, is in serious conflict with archaeologic evidence at several points. Nachikufan III contains pottery, and iron slag was found down to 1.5 ft. depth, immediately overlying Y-619; its 5,000 year date is considered impossibly old. Nachikufan II contains polished stone axes, not known to be older than 6300 years even in North Africa, whence the Neolithic presumably came, and while Y-791 is reasonable, it is the least reliable on technical grounds, and the older dates (Y-620B, Y-625, Y-808) are much too old. Nachikufan I was dated at the Chifubwa rock shelter at 6310 BP (this list No. 24), but if the alkali-soluble fraction of Y-623-624 is arbitrarily selected as consistent with this date, all dates for Nachikufan II and III must be rejected. As the gross error of Y-624-624 shows, there is clearly something wrong about bone charcoal, but bone was not a major constituent of most of the samples, and the direct tests do not suggest that error from this source is quantitatively sufficient to account for the discrepancies. Apart from archaeologic difficulties, which can only be resolved by new excavations, sources of error are probably geochemical (absorption of humic material after burial) and biologic (fractionation of carbon isotopes by food plants, by animals, and by the charring process) (6). See report by Clark (26) on earlier excavations at Nachikufu.

11. **Y-808. Kasama cave, Zambia** 10,820 ± 340
charcoal residue 8870 BP
11,700 ± 280
alkali soluble fraction 9750 BC
From 4.5 to 7.0 ft. depth, Nachikufan II. (6)

12. **Y-620B. Nachikufu cave, Zambia** 9720 ± 550
7770 BC

From 1953 excavation, 3.0 to 3.5 ft. depth. **Comment**: a mislabelled sample (Y-620), supposedly from this layer, gave 400 ± 130 BP and has been rejected (6). Nachikufan II cultural level.

13. **Y-625. Kasama cave, Zambia** 8640 ± 240
6690 BC
From 3.0 to 3.5 ft. depth. Nachikufan II. (6)

14. **Y-805. Kasama cave, Zambia** 7320 ± 200
charcoal residue 5370 BC
7200 ± 200
alkali soluble fraction 5250 BC
From 2.5 to 3.0 ft. depth. Nachikufan III or II. (6)

15. **Y-623-624. Nachikufu cave, Zambia** 3460 ± 200
charcoal residue 1510 BC
7540 ± 600
alkali soluble fraction 5590 BC

Combined samples from 1953 excavation, from 6.0 to 7.0 and 7.0 to 8.0 ft. depth. Nachikufan I cultural level. (6)

16. **Y-791. Nachikufu cave, Zambia** 5630 ± 200
3680 BC

From 2.5 to 3.0 ft. depth, 1953 excavation, dating the Nachikufan II cultural level. **Comment**: Sample very small and not pretreated with alkali (6).

17. **Y-619. Nachikufu cave, Zambia** 5000 ± 200
3050 BC

From 1.5 to 2.0 ft. depth, 1953 excavation, dating the Nachikufan III cultural level. As mentioned above, this date is far too early. (6)

Y-619 bis. Nachikufu cave, Zambia 4830 ± 320
2880 BC

Re-check of Y-619 with new preparation. Also dates Nachikufan III, but it is far too early due to some sort of contamination. (6)

18. **Y-799. Nachikufu cave, Zambia** 1060 ± 100
AD 890

From 5.0 to 7.0 ft. depth, 1955 excavation, dating the Nachikufan II cultural level. **Comment**: This sample presumably represents contaminating Iron Age material from overlying levels and is therefore rejected (6).

Pomongwe series, Rhodesia

Pomongwe cave in the Matopo Hills (20° 32'S; 28° 30'E) has yielded a long cultural succession from Sangoan or Proto-Stillbay at the base, through Stillbay, Magosian and an unusual scraper industry in a white ash layer to Wilton and Iron Age. Excavated 1960/61 by C.K. Cooke (10, 11). For earlier dates, see Middle Stone Age list Nos. 19-22, and Earlier Stone Age list Nos. 13, 14.

19. **SR-12. Pomongwe, Rhodesia** 9400 ± 100
7450 BC

Small twig charcoal associated with the white ash layer and an unusual scraper industry between the Magosian and Wilton levels; very early Wilton (10, 11). From 2 ft. 3 in. depth, Layer 3 I-K 8-10. The sample was combusted twice and counted four times as the age did not agree with that of the white ash from the same layer (11), and Cooke (11) has accepted a suggestion by Swart (11) that the charcoal date (SR-12) be accepted as the more correct for this cultural level. Cooke comments further that the collection of this charcoal was difficult as the whole deposit was so completely burnt. The charcoal was hand-picked from the deposit piece by piece because it was so fragmentary. There is no possibility of any contamination with the level immediately below, which has been dated to 15,800 BP.

20. **SR-13. Pomongwe, Rhodesia** 7690 ± 140
5740 BC

White ash sample, consisting largely of inorganic carbonates, from the same layer as above. It appears to be younger than SR-12 probably as a result of exchange with atmospheric CO_2 (10). The older date (SR-12) is considered by the laboratory and by Cooke (11) to be more accurate.

21. **SR-14. Pomongwe, Rhodesia** 7610 ± 110
5660 BC

The sample was collected from a deposit of ash consisting of a burnt nut from the **Scelerocayre caffra** (Marula) tree. From layer 2 E-G 6-8 and associated with the lower levels of the Wilton. This date is much earlier than others from Wilton levels in the same region. Cooke (11) notes that the sample was taken from the midden immediately above the white ash layer which may account for its unexpected age. A similar reason has been given for the even earlier date of 12,200 BP (No. 9, this list) for the Wilton from Tshangula cave. A lot more dates from similar cultural levels are needed before this problem can be resolved.

Ishango series, Congo

Ishango, on the north western shore of Lake Edward, Congo, was excavated in 1950 by J. de Heinzelin. The occupation horizon, overlain by volcanic tuffs, can be divided into three distinct layers of sediment and contain a unique cultural assemblage with a crude quartz industry, highly developed bone harpoons showing a progressive technical development, bone points, pestles and grindstones, associated with human remains (possibly Negroid), mammal and fish bones (1, 26, 27), but no pottery.

After dating the modern shells (W-284), it was realised that Lake Edward was receiving an addition of C12 from mineral springs and volcanic eruptions, upsetting the normal balance of carbon isotopes and making the dates abnormally old. By extrapolation, de Heinzelin believes the deposit to date between 6500 and 9000 BC (27), while the laboratory (1) concludes that sample W-283 has a maximum age of 18,000 years.

22. **W-283. Ishango, Congo** 21,000 ± 500 19,050 BC

Shells from the culture horizon

W-284. Ishango, Congo 3000 ± 200 1050 BC

Modern shell collected from the present beach.

23. **UCLA-167. Mufo Mine, Angola** 6830 ± 120 4880 BC

Wood from the Upper Sand Bed in the Flats Terrace at a depth of 5 ft. and dating the early Tshitolian cultural phase (8), from waterlaid sands overlying the Upper Gravels of the 3-4m terrace in the centre of the Luembe River valley (25). For general description of the area, see Middle Stone Age list Nos. 15-18.

24. **UCLA-171. Calunda 3 Mine, Angola** 4700 ± 100 2750 BC

Peat and wood from the Lower Stream Gravels exposed just below water level, dating the Tshitolian (25) or the Late Tshitolian (8). See also Middle Stone Age list Nos. 15-18.

25. **UCLA-170. Furi I Mine, Angola** 1800 ± 80 AD 150

Wood from the resorted gravels of the present channel of the Luembe river. Late Tshitolian culture with tools and potsherds indicating resorting in Iron Age times (8), or Early Iron Age (25). **Note**: this date has also been quoted as 1880 ± 80 BP: the date published by the laboratory is taken as the correct one. See also Middle Stone Age list Nos. 15-18.

26. C-663. **Chifubwa Stream rock shelter**, **Zambia** 6310 ± 250 4360 BC

Charcoal from the Chifubwa stream shelter about 4 miles from Solwezi in the Kafue basin. The walls of the shelter show rock engravings of a stylized and schematic nature which have been covered in part by the accumulated cave deposit (29). The sample is from the lowest 18 ins. of an orange sand and the top 4-6 ins. of a Late Stone Age Nachikufan I industry (2).

Clark (29) notes that the charcoals were small fragments scattered throughout the deposit and did not come from a recognizable hearth. It is therefore possible that they may have been old or 'fossil' charcoals washed into the deposit from the top of the gorge. It will therefore be necessary to obtain other confirmatory evidence from other sites before assigning the engravings to this date.

27. **Lv-45. Mt. Gafula, Congo** 6030 ± 190 4080 BC

Charcoal from Mt. Gafula (4° 28'S; 15° 13'E), Province of Leopoldville, in sand at a depth of 2m. The sample is from a factory floor characteristic of the Late Tshitolian (7).

Lochinvar series, Zambia

Lochinvar Ranch, some 27 miles north-west of Monze, Zambia, where Wilton cultural material has been excavated around a hot spring mound to a depth of over 8 ft. Excavated in 1960 by Creighton Gabel and in 1963 by B. M. Fagan. The cultural material was associated with burials, faunal remains, shell beads and vegetable material such as nuts, seeds and reed fragments. Artefacts of wood have also been recovered. Remains of some 16 individuals were found in 1960, and a further 10 in 1963 and Gabel (31) states that they have more affiliations with Bush than with Negro skulls. (30, 32, 8). **Comment**: UCLA-173 and UCLA-174 were the first samples run and the results are not in stratigraphic order. Further samples M-1324 and M-1323 were therefore submitted from the 8 ft. depth. Dates numbered 32, 33 and 34 below have not yet been published from the laboratory and details are therefore not known.

28. **UCLA-174. Lochinvar, Zambia** 4700 ± 100
2750 BC

Wood from a depth of 5 ft. associated with a human skeleton. Collected in 1960 excavations by C. Gabel (8).

29. **UCLA-173. Lochinvar, Zambia** 4300 ± 100
2350 BC

Charcoal from a depth of 8 ft. in association with fossil fauna, Wilton implements and a wooden digging stick. Collected during 1960 by C. Gabel (8).

30. **M-1324. Lochinvar, Zambia** 4650 ± 150
2700 BC

Charcoal from grid square 6L24, 96 in. depth, collected in 1961 by C. Gabel (12).

31. **M-1323. Lochinvar, Zambia** 4450 ± 150
2500 BC

Charcoal from grid square 6L17, 96in. depth, collected 1961 by C. Gabel. Gabel (12) comments that the UCLA dates are therefore probably essentially correct. (30, 31, 33).

32. ? **Lochinvar, Zambia** 4785 ± 70
2835 BC

From Gwisho 'B', excavated in 1963 by B. M. Fagan. Details not known (17).

33. ? **Lochinvar, Zambia** 3680 ± 70
1730 BC

From Gwisho 'B' site, excavated in 1963 by B. M. Fagan (17, 32).

34. ? **Lochinvar, Zambia** 3660 ± 70
1710 BC

From Gwisho 'B' site, excavated in 1963 by B. M. Fagan (17, 32).

35. **BM-57. Amadzimba cave, Rhodesia** 4200 ± 150
2250 BC

Carbonized bone and wood ash from the lower half of the Wilton horizon at a depth of 6 to 12 ins., squares Ce and Cf, at Amadzimba cave (20°45'S; 28°45'E), in the south Matopos. Collected in 1954 by K. R. Robinson. The Wilton industry at this site shows the additional unusual element of a large number of polished bone tools (34, 4).

36. **C-830. Lusu Village, Zambia** 2139 ± 150
189 BC

Charcoal collected in what appeared to be a large hearth in Lusu Village, on the Zambezi river in the Sesheke district of Zambia. The sample was taken by J. D. Clark just above the spot where shards of Stamped Ware pottery of a believed Rhodesian Wilton occupation were found. This is overlain by 2 ft. 7 in. of re-deposited Kalahari sands. The charcoal layer averages just over 1 in. thick and extends for 8 ft. along the face of the section. (3)

The date is the average of two samples: 2025 ± 230 BP and 2353 ± 180 BP. (3)

37. **SR-15. Dombozanga, Rhodesia** 1220 ± 100
AD 730

Dombozanga rock shelter in Rhodesia between Beit Bridge and Bulawayo. Charcoal was collected throughout the Wilton deposit from 8 to 10 ins. below the surface. Above the 8 in. level, Wilton was mixed with Iron Age potsherds. (10, 37)

Kisese rock shelter series, Tanzania

Kisese II rock shelter in the Kondoa district (4°25'S; 35°50'E) of Tanzania, was excavated in 1956 by R. R. Inskeep to a depth of 20 ft. below the modern ground surface. An unbroken succession of stone industries was recognized, ranging from Second Intermediate, through Wilton to evidence of Iron Age activity in the topmost levels. The shelter has some rock paintings on the walls and exfoliated slabs of rock were found in the deposit and may help to date the paintings (35, 13).

The material dated was charred ostrich eggshell; however the dates seem far too old and are not in strict stratigraphic order so that in view of the careful pretreatment given to the samples, the suitability of ostrich eggshell requires investigation (13).

38. **NPL-37. Kisese rock shelter, Tanzania** 18,190 ± 306
16,240 BC

Sample from the transition stage between the Second Intermediate and the Later Stone Age. (13)

39. **NPL-35. Kisese rock shelter, Tanzania** 14,760 ± 202
12,810 BC

Sample from the middle part of the Later Stone Age sequence. (13)

40. **NPL-36. Kisese rock shelter, Tanzania** 10,720 ± 132
8770 BC

Sample from the early part of the Later Stone Age sequence. (13)

41. **Y-91. Njoro River cave, Kenya** 2920 ± 80
970 BC

Njoro River cave on the banks of the Njoro river (approx. 0° 20'S; 35° 58'E) in Kenya was excavated in 1938 by Dr. and Mrs. L. S. B. Leakey. In a series of parallel trenches, cremated burials of about eighty individuals were found associated with obsidian implements of Elmenteitan facies, potsherds, stone bowls, pestles, lower grindstones, considerable quantities of stone beads, a single carved wooden vessel, basket-work, gourds, but no trace of metal (36). Charcoal was collected from several graves for dating (9).

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IV. IRON AGE

a. SOUTH AFRICA

	Lab. No.	Date B.P. / B.C.	Site	Associations	Sample	Reference
1.	Y-135-17	900 ± 65 AD 1050	Bambandyanalo, Transvaal	Iron Age burial	Charred millet	8
2.	Y-1338	890 ± 50 AD 1060	Melville Koppies, Transvaal	Iron Age I	Charcoal	20
3.	Y-135-14	570 ± 60 AD 1380	Mapungubwe, Transvaal	Iron Age settlement	Charcoal	8
4.	Y-135-9	530 ± 60 AD 1420	"	"	Charred millet	"
5.	Y-1323B	300 ± 80 AD 1650	Uitkomst Cave, Transvaal	Iron Age	Charcoal	20
?	BM-	9844 ± 200 7894 BC	"	Probably Later Stone Age contamination	"	27

b. CENTRAL AFRICA

	Lab. No.	Date B.P. / B.C.	Site	Associations	Sample	Reference
?* 6.	C-662	4078 ± 300 2128 BC	Situmpa, Zambia	Early Bantu penetration ?	Charcoal	2
* 7.	C-829	1854 ± 220 AD 96	"	Check sample against C-662	"	5
8.	SR-17	1650 ± 100 AD 300	Ziwa Farm, Rhodesia	Iron Age grave	"	15
9.	SR-32	1100 ± 100 AD 850	"	Iron Age ritual pit	"	"
10.	SR-38	1050 ± 100 AD 900	"	Iron Age grave	"	"
11.	SR-26	1420 ± 120 AD 530	Gokomere, Rhodesia	Iron Age: Stamped Ware	Wood charcoal	"
?*12.	C-917	1506 ± 305 AD 444	Zimbabwe, Rhodesia	Drain lintel from 'Temple'	Wood	5
?*13.	C-613	1361 ± 120 AD 589	"	"	"	2
? 14.	GL-19	1240 ± 80 AD 710	"	"	"	26
15.	M-913	1630 ± 150 AD 320	"	End of Period I	Charcoal	3
16.	M-914	875 ± 150 AD 1075	Zimbabwe, Rhodesia	Period III on 'Acropolis'	"	3
17.	M-915	510 ± 150 AD 1440	"	Period IV on 'Acropolis'	"	"
18.	B-263	1240 ± 120 AD 710	Sanga, Congo	Kisalian Culture	Bone	6
19.	B-264	1070 ± 200 AD 880	"	"	"	"
20.	L-395B	1080 ± 180 AD 870	Kalambo Falls, Zambia	Early Iron Age 'Channelled Ware'	Charcoal	7

b. CENTRAL AFRICA (cont.)

	Lab. No.	Date B.P. / B.C.	Site	Associations	Sample	Reference
21.	SR-33	1110 ± 100 AD 840	Malapati, Rhodesia	Iron Age midden: Stamped pottery	Charcoal	15
22.	Y-587	1240 ± 100 AD 710	Feti la Choya, Angola	Fortified Iron Age site	"	14
23.	Y-588	700 ± 65 AD 1250	"	"	"	"
24.	SR-19	1300 ± 90 AD 650	Isamu Pate, Zambia	Iron Age mound, Kalomo Culture	"	21
25.	R-874(NZ)	995 ± 61 AD 955	"	"	"	"
26.	UCLA-177	960 ± 70 AD 990	"	"	"	13
27.	SR-30	930 ± 100 AD 1020	"	"	"	21
28.	UCLA-176	890 ± 70 AD 1060	"	"	"	13
29.	UCLA-175	710 ± 50 AD 1240	"	"	"	"
30.	SR-31	900 ± 90 AD 1050	"	"	"	21
31.	SR-20	910 ± 100 AD 1040	"	"	"	"
32.	SR-23	1150 ± 100 AD 800	Ingombe Ilede, Zambia	Iron Age village	"	"
33.	SR-22	1120 ± 200 AD 830	"	"	"	"
34.	Q-720	965 ± 100 AD 985	"	"	"	19
35.	R-908(NZ)	486 ± 87 AD 1464	"	"	"	42
36.	GrN-3580	930 ± 40 AD 1020	Kalambo Falls, Zambia	Iron Age	?Charcoal	21
37.	GX-0109	750 ± 135 AD 1200	Sebanzi Hill, Zambia	Iron Age: Tonga pottery	Charcoal	"
38.	SR-28	800 ± 100 AD 1150	Kamusongolo cave, Zambia	Iron Age: comb-stamped pottery	"	15
39.	SR-37	800 ± 90 AD 1150	Mutema's Sacred Grove, Rhodesia	Iron Age	Wood	15
40.	SR-36	720 ± 120 AD 1230	"	"	"	"
41.	Y-722	670 ± 100 AD 1280	Graniteside, Rhodesia	Iron Age burial site	Charcoal	10
42.	GrN-2341	680 ± 60 AD 1270	"	"	"	18
43.	SR-25	650 ± 120 AD 1300	Harleigh Farm, Rhodesia	Iron Age: Zimbabwe Culture	"	15
44.	GrN-3189	370 ± 50 AD 1580	Kalambo Falls, Zambia	Iron Age	?Charcoal	21

b. CENTRAL AFRICA (cont.)

	Lab. No.	Date $\frac{\text{B.P.}}{\text{B.C.}}$	Site	Associations	Sample	Reference
45.	Y-618	300 ± 200 AD 1650	Nachikufu Cave, Zambia	Iron Age	Charcoal	11
46.	Y-796	200 ± 100 AD 1750	"	"	"	"
47.	SR-35	280 ± 90 AD 1670	Harleigh Farm, Rhodesia	Iron Age	"	15
c.	EAST AFRICA					
48.	M-1113	925 ± 150 AD 1025	Nsongezi, Uganda	Iron Age: Dimple-based pottery	"	12
?49.	M-1114	125 ± 150 AD 1825	"	Sample contaminated	"	"
50.	Y-570	375 ± 100 AD 1575	Lanet, Kenya	Lanet earthworks	"	10
51.	BM-52	100 ± 150 AD 1850	Gaan Nibaah, Somaliland	Recent grave	Wood	9
d.	WEST AFRICA					
52.	Y-475	4060 ± 140 2110 BC	Nok, Nigeria	Nok figurines	"	1
53.	Y-142-4	2875 ± 70 925 BC	"	"	"	"
54.	Y-474	1750 ± 80 AD 200	"	"	"	"
e.	OTHER					
55.	GaK-276	840 ± 80 AD 1110	Talaky, Madagascar	Settlement with iron	Charcoal	4

ADDITIONAL NOTES ON IRON AGE DATES

Bambandyanalo and Mapungubwe series

Mapungubwe Hill and the nearby site of Bambandyanalo (K. 2) (22^{0} 05' S: 29^{0} 20' E) are on the farm Greefswald in the Northern Transvaal. K. 2 and the 'great depression' on the Mapungubwe Hill summit were excavated in 1935-40 by Capt. G. A. Gardner whose account and conclusions have been recently published (24). The skeletal remains are considered to be Khoisan from Bambandyanalo, but the later inhabitants show mixing with the Bantu (22). While Gardner considers that the Hottentot occupants in the lower levels are not Iron Age **per se**, Fagan (23) considers that the whole sequence must be considered as Iron Age and compares the pottery styles with those from Rhodesia.

The cultural sequence as recognized by Gardner from K. 2 (Bambandyanalo) and from the Hill (Mapungubwe) is as follows:

Lowest levels: Stone Age Magosian material on the summit of the Hill. Not dated. Depth: 10-11 ft. below surface.

K. 2, 1st Phase: Proto-Hottentot cultural and skeletal evidence. No traces of permanent huts or stone walling. Abundant well-made pottery of Schofield's M. 2 class (58), evidence for the domestication of cattle (Afrikander and Sanga types) and highly probable evidence for sheep as well. No evidence for iron smelting, but 16 of the 72 burials had iron or copper bracelets and anklets and a single copper finger ring was recovered. Very few finds of metal weapons. Dated to AD. 1050 (Y-135-17).

K. 2, 2nd Phase: Proto-Hottentots and so-called Nguni Bantu invaders mix; mixed pottery and isolated find of iron hoe. Destruction of K. 2.

Hill, 3rd Phase: The lower levels of the great depression on Mapungubwe Hill yielded 11 ft. of deposit. Overlying the Stone Age Magosian horizon is some 2 ft. of accumulated deposit, which Gardner attributes to a hybrid Hottentot/Bantu population. The pottery shows a survival of the Phase 1 tradition, cane and garden roller beads are present. Iron assegaais and spears were also recovered. An interesting hut complex with a carved wooden door is the earliest such dwelling from the site.
Gardner's Zone 2; Depth 7-9 ft. from surface.
Suggested date: AD 1250-1300

Hill, 4th Phase: People with Sotho pottery tradition occupied site and a thick layer of black ash separates 3rd and 4th phases. Pottery classed as Schofield's M. 1 (58). Finding of a spindle-whorl suggests weaving of bark cloth: iron hoes and evidence for metal working found. Charred millet attests to agriculture.
Gardner's Zone 3; Depth 5-7 ft. Dated to A.D. 1380 (Y-135-14).

Hill, 5th Phase: People of Venda stock apparently occupied the Hill; another thick layer of ash separated phases 5 and 4. New types of beads and pottery introduced. Evidence for stone walling and iron smelting, as well as for cattle and agriculture.

Gardner's Zone 4; Approximately 4 ft. depth from surface. Dated to A.D. 1420 (Y-135-9).

Hill, 6th Phase: Remains attributed to Hottentot settlement of the Hill summit: remarkable numbers of bone arrows found, also gold with burials on the Hill which Gardner attributes to contact with the Venda. No indication of cultivation of grain, but there is evidence for cattle and sheep. Historical tradition suggests that these may have been migrant Korana Hottentots.

Gardner's Zone 5: Depth 2-3 ft. from the surface. Suggested date about A.D. 1750-1800.

Hill, 7th Phase: A complete desertion of the Hill.

See also original excavation report by Fouché (25).

1. **Y-135-17. Bambandyanalo, Transvaal** 900 ± 65
AD 1050

Charcoal accompanying ceremonial beast-burial No. 6, with 14 pots from Site K.2, depth 5.5 ft; blocks 4-6, strip 6, co-ordinates A-14', R-7 (8).

3. **Y-135-14. Mapungubwe, Transvaal** 570 ± 60
AD 1380

Charred millet and wood from a burned hut found at position 35' 0' 5' (5 ft. depth) in block 6, strip 4. (8).

4. **Y-135-9. Mapungubwe, Transvaal** 530 ± 60
AD 1420

Charred millet from position 6' 58' 3' (3 ft. depth) in block 2, strip 4 (8).

2. **Y-1338. Melville Koppies, Transvaal** 890 ± 50
AD 1060

Melville Koppies, situated in suburban Johannesburg, is a Nature Reserve where surface finds of pottery led to excavations by Dr. R.J. Mason in 1963. An Iron Age furnace was recovered and this dated sample consisted of charcoal nodules taken from the inside of the furnace at a level of 11" to 12" below datum, the level of the living floor from which the furnace was worked. There is every indication that the charcoal was burnt in the operation of the furnace itself and there is no evidence of contamination from earlier levels. The furnace is probably associated with a nearby stone-walled settlement and with comb-stamped pottery (20).

5. **Y-1323B. Uitkomst Cave, Transvaal** 300 ± 80
AD 1650

BM- 9844 ± 200
7894 BC

Sample Y-1323 B was from the surface of the uppermost furnace in Bed 3 of Uitkomst cave, excavated by R.J. Mason. Evidence of the basic features of an Iron Age community in the form of smelting furances, pottery, stone walls and grindstones were found in Beds 2-4 overlying an earlier Later Stone Age deposit.

The two smelting furnaces from Bed 2 are considered to be of a more primitive type than those in Bed 3 (27).

The BM- sample which gave an anomalously old date was found, after subsequent excavation, to be part of the Later Stone Age horizon as the builders of the smelting furnace had in part excavated into the earlier deposit (20, Mason **pers. comm.**)

6. C-662. **Situmpa Forest Station, Machili district, Zambia** 4078 ± 300
2128 BC

Charcoal from pits dug in the Situmpa Forest and taken at the 5 ft. level. Collected by J.D. Clark was originally submitted as it was presumed to tie up with an archaeological locality and it was hoped it would prove a clue as to the age of the Bantu penetration of Barotseland (4). See C-829 below.

7. C-829. **Situmpa Forest Station, Zambia** 1854 ± 220
AD 96

Charcoal from a depth of 2 ft. 10 ins. in a check pit excavated in 1952 by J.D. Clark. The associated industry includes sherds of Stamped ware (Bambata variant) which is not believed to be as old as indicated by C-662 above. This pit was dug some 5 yds. away from the earlier excavation to check the anomalously early date (5). The pottery is discussed by Inskeep (28) and by Summers (29).

Ziwa Farm series, Inyanga, Rhodesia

Ziwa farm, adjoining the Van Niekerk Ruins at Inyanga which have been described by Summers (31), has been investigated by F.O. Bernhard of Umtali. He has excavated several burials, the skeletal remains being of Negroid type, and has described two distinct types of smelting furnaces (30). These form part of the Ziwa culture. Geographical position: 18° 12' S; 32° 40' E.

8. **SR-17. Ziwa Farm, Rhodesia** 1650 ± 100
AD 300

Charcoal from a grave site at a depth of 2 ft. 4 ins. Skeleton was that of a young female, about 14 years old (15).

9. **SR-32. Ziwa Farm, Rhodesia** 1100 ± 100
AD 850

Charcoal from a ritual pit (15).

10. **SR-38. Ziwa Farm, Rhodesia** 1050 ± 100
AD 900

Charcoal found attached to a skull of a young male, about 16 years old, in a grave excavated on Ziwa Farm (15).

11. **SR-26. Gokomere, Rhodesia** 1420 ± 120
AD 530

Midden deposit from 60 to 66 ins. depth at the Tunnel Site (19° 55' S; 30° 45' E) at Gokomere near Zimbabwe, Rhodesia. A passage-like rock shelter, the site was originally excavated by Gardner (32), but the material has been lost and subsequent investigations were conducted in about 1962 by K.R. Robinson (16). The cultural assemblage shows close affinities with that from the Chibi district (34) and with the Class 1 pottery from the Western Enclosure of the Acropolis, Zimbabwe (35).

Zimbabwe series, Rhodesia

Samples from the Zimbabwe ruins complex (20° 15' S; 30° 56' E) dating the Iron Age sequence. Excavated by various workers (33) and latterly by Summers and Robinson in 1958 (35), the following succession has been recognized in the Western Enclosure on the Acropolis hill:

Period I: At the base of the sequence. Class 1 pottery with stamp and channel decoration.
Period II: Class 2 ware with gourd-shaped pots with rare decoration.
Period III: Class 3 ware; bevelled or rolled rims with rare incised decoration.
Period IV: Class 4 ware; engraved and incised geometrical designs and graphite burnish.
Period V: Class 5 ware with cross-hatched decoration and rough pots.

In 1950 a piece of wood serving as a lintel to a drain was excavated from the Temple or Great Enclosure and was submitted for dating first to Libby (2), C-613, but the date was much earlier than was expected and a second lintel was tested, C-917 (Libby, (5)) and again by Zeuner (26) as GL-19. All the dates gave similar results and it was found that the wood used for the lintels was from the heart of the Tambootie or African Sandalwood (**Spirostachys africana**) tree, a slow-growing hardwood which is never cut for timber as the sap is poisonous. The inference is that the logs may have lain dead for some considerable time before being used as drain lintels. Subsequent dates from charcoal on the Acropolis show that the main period of occupation was considerably later than these original dates suggested. The earlier dates have been discussed in detail by Summers (36, 37).

12. C-917. Zimbabwe, Rhodesia 1506 ± 305
AD 444

Wood from a drain lintel in the Temple or Great Enclosure, this was the second sample submitted and is not considered to date the building of the drain (5, 35, 36, 37).

13. C-613. Zimbabwe, Rhodesia average of three 1361 ± 120
AD 589

Wood from a drain lintel in the Temple. Three tests were run and gave the following results: 1415 ± 160, 1344 ± 160 and 1271 ± 260 B.P. After further examination of the wood, the date was not considered to have been contemporary with the building of the drain.

14. GL-19. Zimbabwe, Rhodesia 1240 ± 80
AD 710

Wood from the same log as C-917. See above comment and references; also Zeuner (26).

15. **M-913. Zimbabwe, Rhodesia** 1630 ± 150
AD 320

Charcoal from the excavations on the Acropolis. This sample dates the end of the earliest Southern Rhodesian Iron Age, showing that Period II began about the fourth century. There is no date for the beginning of Period I from Zimbabwe, but a somewhat similar ware to Class 1 has been dated from the Zambezi Valley at AD 96 (this list No. 7). Fuller descriptions are given by Robinson (**in** 35). (3)

16. **M-914. Zimbabwe, Rhodesia** 875 ± 150
AD 1075

Charcoal from the middle level, Period III, on the Acropolis; taken from Test I, Layer 13 (3, 35).

17. **M-915. Zimbabwe, Rhodesia** 510 ± 150
AD 1440

Charcoal from the highest level, Period IV, and dating the end of the early walling phase and beginning of the period associated with the best quality walling (Type Q), (3, 35).

Sanga series, Congo

Excavations were carried out at Sanga, territory of the Bukama, Katanga Province, Congo, in 1957 by J. Nenquin (38) and the Kisalian culture was isolated on the basis of a typical pottery style, metal working and good evidence for fishing. Very little charcoal was found and the measurements were made from two of the 27 skeletons buried at the site, (39).

18. **B-263. Sanga, Congo** 1240 ± 120
AD 710

The grave goods from this burial (No. 18) included typical Kisalian pottery, iron and a necklace of ostrich eggshell beads (6).

19. **B-264. Sanga, Congo** 1070 ± 200
AD 880

No pottery was found with this burial (No. 10), but the metal objects are similar to the material from other graves containing typical Kisalian pottery, (6).

20. **L-395B. Kalambo Falls, Zambia** 1080 ± 180
AD 870

Charcoal with associated pottery from gray sands and clays near the middle of the Iron Age deposit (6.5 to 7.0 ft. in depth) at Site A 1. Since sherds throughout the deposit are essentially of the same type, the sample should roughly date the Channeled Ware culture. Because the date does not indicate the complete time range of the culture at the site, Clark (7) suggests that the culture may extend back to between 1500 and 2000 BP. **Comment** (by the laboratory): The date given is for a sample portion pretreated for humic-acid removal. An untreated portion gave an age of 1010 ± 100 (7). For further information about the
AD 940
site, see Early Stone list Nos. 1-12.

21. SR-33. Malapati, Rhodesia 1110 ± 100
AD 840

Charcoal from a midden associated with a river-bank kraal site on the Nuanetsi River near the Malapati dip tank (22° 03' S; 31° 25' E) almost due south of Zimbabwe, collected in 1961 by K.R. Robinson. The charcoal was collected throughout the midden which averaged 8 ins. thick and rested on natural earth. It was overlain by 3 to 4 ins. of sandy soil. The midden produced stamped pottery which, although related to the wares of Gokomere and Mabveni, shows new features which Robinson (33, p. 160) suggests may be linked with the pottery believed to have been made by the ancient Kwena who later became known as the Ngwato. The type site of this ware is Maokagani Hill in Bechuanaland (33, 15).

Feti la Choya series, Angola

Feti la Choya, the traditional burial place of Choya, legendary primal queen of the Ovimbundu, near the confluence of the Kuene and Kunyongamua Rivers (13° 26' S; 15° 53' E). Charcoal samples were taken from a large midden, part of a large fortified site containing stone-work and evidence of intensive iron smelting, in a shaft (sunk by treasure hunters) at the south side of the midden. Sterile soil was encountered at a depth of 2.5 m. The Social Anthropology of the Ovimbundu has been described by G.M. Childs (40), who collected the samples (14, 41).

22. Y-587. Feti la Choya, Angola 1240 ± 100
AD 710

Sample from the bottom layer overlying sterile soil and associated with pottery and faunal remains.

23. Y-588. Feti la Choya, Angola 700 ± 65
AD 1250

Sample from the lower layer of the midden, about 1.5 m. above the sterile soil in the same shaft as Y-587.

Clark (14) comments that the dates bracket the time of the first stone walling at Zimbabwe.

Isamu Pate series, Kalomo, Zambia

Isamu Pate Mound, 10 miles west of Kalomo, was first investigated in 1960 and 1961 by B.M. Fagan. The mound, formed by ash and accumulated midden refuse of the early Iron Age inhabitants, is some 10 ft. deep and is the type-site for the Kalomo Culture. The excavated material indicates a mixed farming economy with evidence for the hoe-cultivation of Kaffir corn and the keeping of cattle, sheep or goats, and dogs. There was an emphasis on hunting in the earlier stages. Iron working was also practised but on a small scale, and there is evidence for circular huts of the pole and daga type. The Kalomo Culture is considered by Fagan (13) to be derived in part from the Situmpa Culture (= Channelled Ware pottery). Some ten burials were recovered. The following dates have been published with full details: R-874, UCLA-177, UCLA-176, UCLA-175. The other dates in this list (21) are not yet published in detail.

24. **SR-19. Isamu Pate, Zambia** 1300 ± 90
AD 650

Sample from bedrock at 117 ins. (21)

25. **R-874 (NZ) Isamu Pate, Zambia** 995 ± 61
AD 955

Sample from 90 ins. depth; charcoal (21). Previously published as AD 967 (42).

26. **UCLA-177. Isamu Pate, Zambia** 960 ± 70
AD 990

Charcoal from the remains of a hearth in Strip 1, Square A5, at a depth of 73 ins. (13).

27. **SR-30. Isamu Pate, Zambia** 930 ± 100
AD 1020

Sample from a depth of 42 ins. (21).

28. **UCLA-176. Isamu Pate, Zambia** 890 ± 70
AD 1060

Charcoal from a burnt log in a hearth in Strip 1, Square B1, at a depth of 40 ins. (13).

29. **UCLA-175. Isamu Pate, Zambia** 710 ± 50
AD 1240

Charcoal from a posthole in Square A2, Strip 1. at a depth of 15 ins. (13).

30. **SR-31. Isamu Pate, Zambia** 900 ± 90
AD 1050

Sample from a depth of 18 in. (21).

31. **SR-20. Isamu Pate, Zambia** 910 ± 100
AD 1040

Sample from a depth of 9-10 ins. (21).

Note: On statistical grounds, Mr. S. Daniels (21) has shown that the 'least improbable chronology' for Isamu Pate covers the period 725 - 1200 AD. For additional information see: 42, 43, 44, 28, 21, 13.

Ingombe Ilede series, Zambia

Ingombe Ilede (16° 10' S: 28° 47' E) is an ash-topped ridge on the north bank of the Zambezi, 32 miles downstream from the Kariba Dam and below the confluence of the Lusitu River. Originally investigated by J. Chaplin in 1960 (17), further excavations were undertaken by B. M. Fagan in 1961 and 1962. A total of 46 individual burials were found, of which 4 in the central area were associated with unusually rich grave goods. The excavations showed some 8 ft. of deposit in which there are significant changes in pottery styles: the earliest pots are rather rough and the later ware consists of shallow, thin-walled bowls and beakers with incised and comb-stamped decoration and graphite burnishing. The inhabitants practised a mixed hunting and farming economy at a time when the tendency was towards greater specialization in domestic stock and agriculture (Fagan, 42).

The four richest burials show a large number of trade goods such as cloth, gold and glass beads, copper bangles, a single copper razor, copper crosses, mpande shell necklaces and leather amulets presumed to be of Arab origin (Fagan (42)). The presence of the other poorly decorated burials has led Fagan (42) to suggest that the settlement may have been a village whose principal inhabitants were engaged in trading, while the common people were the food producers.

32. **SR-23. Ingombe Ilede, Zambia** 1150 ± 100
AD 800

Sample from a depth of 36 ins. (21)

33. **SR-22. Ingombe Ilede, Zambia** 1120 ± 200
AD 830

Sample from a depth of 30 ins. (21)

34. **Q-720. Ingombe Ilede, Zambia** 965 ± 100
AD 985

Wood charcoal submitted as a cross-check with SR-23 (19).

35. **R-908 (NZ). Ingombe Ilede, Zambia** 486 ± 87
AD 1464

Sample from a depth of 90 ins. (21). The date listed here is that published by Fagan in 1963 (42): the sample has also been quoted as AD 680 ± 40 (21).

36. **GrN-3580. Kalambo Falls, Zambia** 930 ± 40
AD 1020

Sample from Site B2, at a depth of 2.10 m. in the Iron Age levels at the Kalambo Falls site. Details of the associations are not yet published (21). Further information about the site is in the Early Stone Age list No. 1-12.

37. **GX-0109. Sebanzi Hill, Lochinvar Ranch, Zambia** 750 ± 135
AD 1200

Sebanzi Hill on the Lochinvar Ranch some 27 miles north-west of Monze in Zambia was excavated in 1963 and 1964. In some 5 ft. 6 ins. of cultural deposit a sequence of pottery styles has enabled the development of Tonga pottery to be traced from the Eleventh through to the Twentieth Centuries. This sample is from the earlier part of the sequence (21, 45).

38. **SR-28. Kamusongolo Kopje Cave, Zambia** 800 ± 100
AD 1150

Charcoal from the Kamusongolo Kopje Cave (13° 27' S; 25° 51' E) near Kasempa, which was excavated by S.G. Daniels of the National Monuments Commission. Overlying a Wilton deposit, the Iron Age levels are associated with comb-stamped pottery (21, 15).

Mutema's Sacred Grove series, Rhodesia

Mutema's Sacred Grove (19° 59' S; 32° 33' E), an Iron Age site, excavated by A. Whitty of the Historical Monuments Commission of Rhodesia. Details of the site and finds have not yet been published (15).

39. **SR-37. Mutema's Sacred Grove, Melsetter, Rhodesia** 800 ± 90
AD 1150

A wood post from below the surface. (15).

40. **SR-36. Mutema's Sacred Grove, Melsetter, Rhodesia** 720 ± 120
AD 1230

Sample from a wood post found on the surface before the excavation had started (15).

Graniteside series, Salisbury, Rhodesia

The Graniteside Iron Age site (17° 50' S; 31° 05' E) was excavated in 1958-1959 to a depth of about 4½ ft. A number of shaft graves were found to contain burial goods such as iron bangles, beads and a large number of whole pots, the majority of which were plain and undecorated. The skeletal material is considered to be non-Bantu, and comparable to the remains from Mapungubwe (10, 46, 18).

41. **Y-722. Graniteside, Rhodesia** 670 ± 100
AD 1280

Charcoal from inside one of the pots (10).

42. **GrN-2341. Graniteside, Rhodesia** 680 ± 60
AD 1270

Charcoal from the inside of pots (18).

43. **SR-25. Harleigh Farm, Rusape, Rhodesia** 650 ± 120
AD 1300

A charcoal sample from carbonized posts overlain by an early floor of the Zimbabwe Culture settlement on Harleigh Farm (18° 32' S; 32° 05' E). Collected and submitted by P. A. Robins. This represents a **post quem** date for the settlement (15).

44. **GrN-3189. Kalambo Falls, Zambia** 370 ± 50
AD 1580

Sample from site B2, depth 60-90 cm. in the Iron Age levels at Kalambo Falls at the southern end of Lake Tanganyika (21). See also Early Stone Age list Nos. 1-12.

Nachikufu Cave series, Zambia

Charcoal from the Iron Age levels at Nachikufu Cave (12° 14' S; 31° 15' E). There is evidence for iron smelting in the outer part of the cave and Clark (47) states that the evidence of beads from the earlier excavations suggest at the earliest an 18th century date for the upper part of the occupation. (11, 47). See also Later Stone Age list No. 12-18.

45. **Y-618. Nachikufu Cave, Zambia** 300 ± 200
AD 1650

Sample collected during 1953 excavations at a depth of 0.5 to 1.0 ft. (11).

46. **Y-796. Nachikufu Cave, Zambia** 200 ± 100
AD 1750

Sample collected during 1955 excavations at a depth of 2.0 to 3.0 ft. (11).

47. **SR-35. Harleigh Farm, Rusape, Rhodesia** 280 ± 90
AD 1670

A charcoal sample from the same farm as No. 43 above. Collected by J.R. Crawford, the sample was obtained from a pit sealed by deposits of an early occupation of the site and comes from a midden containing pottery of the earliest type found on the site which is the ancestral home of the Chipunza Chieftaincy (15).

Nsongezi Rock Shelter series, Uganda

The Nsongezi Rock Shelter (0° 59' S; 30° 45' E) is situated on the left bank of the Kagera River in the Ankole district of south-west Uganda. The site was first excavated in 1932 by E.J. Wayland, and subsequently in 1935 by T.P. O'Brien and by C. van Riet Lowe in 1937. These samples are from the latest excavations conducted by M. Posnansky and S.V. Pearce in 1961. In 7-8 ft. of deposit the industry is clearly Late Wilton with pottery appearing in the top 4 ft. O'Brien (48) divided the industry into two stages on the basis of the pottery, but C. van Riet Lowe (49) believed the industry to be an homogenous one with pottery throughout. Posnansky and Pearce (50, 52) agreed in general with the conclusions of O'Brien and found a succession of recent pottery, Bigo Culture and later, in the top 3 ft. partly underlain by Dimple-based Ware at 2 to 4 ft. Iron ware in the form of an iron arrowhead, an iron spear-butt and a wrought iron needle were recovered by various excavators in the top 3 ft. of deposit (12, 53) M-1113 provides a date for the Dimple-based pottery of East Africa, but M-1114 appears to have been contaminated with recent carbon.

48. **M-1113. Nsongezi, Uganda** 925 ± 150
AD 1025

Sample from a hearth overlain by brown cave earth much riddled by roots and burrowing animals, 3.5 to 4 ft. thick. The hearth was not more than 6 ins. at its maximum thickness. (12).

49. **M-1114. Nsongezi, Uganda** 125 ± 150
AD 1825

From the 2-4 ft. level and associated with pottery with roulette decoration.

Comment: Sample liable to contamination (12).

50. **Y-570. Lanet II, Nakuru, Kenya** 375 ± 100
AD 1575

Lanet (0° 18' S; 36° 07' E), near Nakuru, was excavated in 1957 by M. Posnansky. The settlement consists of up to 60 earthen hollows dug into the slope of a hill which was surmounted by an irregular triangular shaped enclosure with a 15 ft. high earth bank, suggested by Posnansky (51) to be a large cattle Kraal. Three of the hollows or houses were excavated and the finds consisted of pottery of the Lanet Culture (related to the assemblage from Hyrax Hill (51)) decorated with roulette and single cord motifs, a few stone bowls (similar to the Gumban B), a variety of bone leather dressing tools, but no evidence of iron. The bones of domestic animals were also found. The sample submitted for dating was charcoal from a hearth beneath the ground surface and unlikely to have post-dated the earthworks. (10, 51, 54).

51. **BM-52. Gaan Nibaah, Somaliland** 100 ± 150
AD 1850

Wood from Gaan Nibaah ($9^{\circ}52'$ N; $44^{\circ}48'$ E) found at ground level at the bottom of a mound burial of a type of grave attributed to the pre-Somali inhabitants, the Galla. **Comment**: There are no comparative dates and this one would seem to imply that the grave is recent and probably Somali rather than Galla. Collected in 1957 by I. M. Lewis. (9, 55).

Nok series, Nigeria

Samples from the alluvial deposits exposed in the Main Paddock of the tin mine on the Nok River near Jos, Nigeria. The basal gravels of the youngest alluvial body contain pottery and terra-cotta figurines and some evidence of metal working (1). Fagg (56) states that sample Y-142-4 came from an abraded semi-carbonized tree trunk and assumes it to be therefore earlier than the deposits in which it was found. He therefore dates the figurine culture to the period between about 500 BC and AD 200, bearing in mind that the introduction of iron working is unlikely to have occurred before about 500 BC. The very early date of Y-475 has not been explained, but the sample used may have been derived.

52. **Y-475. Nok, Nigeria** 4060 ± 140
2110 BC

From site Nok H; carbonized wood from the sand and gravel at the main figurine horizon overlying the basal gravel of the younger alluvial body recovered during the 1956 excavations. (1).

53. **Y-142-4. Nok, Nigeria** 2875 ± 70
925 BC

From site Nok D; wood from the sand overlying the basal gravel of the youngest alluvial body recovered during the 1951 excavation.

54. **Y-474. Nok, Nigeria** 1750 ± 50
AD 200

From site Nok G: wood with bark adhering from the black clay overlying the sand and gravel of the youngest alluvial body recovered during the 1956 excavations. (1).

55. **GaK-276. Talaky, Madagascar** 840 ± 80
AD 1110

Charcoal from 1 mile east of Talaky, Ambany, Tsihombe, Madagascar ($28^{\circ}28'$ S; $48^{\circ}21'$ E) in a fireplace located in square C4 and C5 in Zone B, site 2, 20 cm below the surface. Associated with pottery, iron hooks and other artifacts, the date indicates that iron was known in the beginning of the second millenium in the area. Collected and submitted by P. Vérin. (57, 4).

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C. DATES OF PALAEO-ENVIRONMENTAL INTEREST

	Lab. No.	Date B.P. / B.C.	Site	Cultural Association	Climatic Implication	Evidence	Reference
1.	GrN-2644	57,600 ± 750 55,650 BC	Kalambo Falls, Zambia	Late Acheulian	Warmer and drier	Pollen	5
2.	11 dates ranging between >52,000 BP and 22,600 BP		"	Final Acheulian through transitional Acheulian/Sangoan to full Sangoan	Cooler and wetter Warmer and drier Present day temperatures Warm and probably drier Probably cooler and wetter	"	"
3.	UCLA-168	38,000 ± 2500 36,050 BC	Mufo, Angola	Sangoan/Lower Lupemban	Open vegetation	"	1
	UCLA-169	34,000					
4.	Y-103 C-850 L-271B	>44,000 >41,000 >35,000	Florisbad, South Africa	Early Middle Stone Age Age	Warmer and drier	"	2
5.	SR-39	35,530 ± 780 33,580 BC	Pomongwe, Rhodesia	End of Stillbay Middle Stone Age	Wetter	Increased exfoliation	3
6.	Lv-44 Lv-47	30,000 30,000	Lemba and Basoko R., Congo	Lupemban	Dry period	Erosion	6
7.	L-399 I	27,500 ± 2300 25,550 BC	Kalambo Falls, Zambia	Lupemban	Warmer and probably wetter	Pollen	5
8.	L-271C	28,450 ± 2200 26,500 BC	Florisbad, South Africa	Middle Stone Age: Peat II	Wetter and drier conditions oscillating during period between Peat II and Peat III	"	8
	L-271D	19,530 ± 650 17,580 BC		Middle Stone Age: Peat III			
9.	UCLA-229	22,800 ± 1000 20,850 BC	Twin Rivers, Zambia	Middle Stone Age	Cooler and wetter	Travertine formation	7
10.	C-581	14,503 ± 560 12,553 BC	Mufo, Angola	Late Upper Lupemban	Cooler but not necessarily wetter	Pollen	7
11.	I-556	14,700 ± 290 12,750 BC	Mahoma Lake, Uganda	Nil	Beginning of the final glacial retreat in the Ruwenzori	Geological	13
12.	GrN-3048	12,650 ± 100 10,700 BC	Cherangani, Kenya	Nil	Cool period coincident with European Oldest Dryas	Pollen	12
13.	L-395D	9550 ± 210 7600 BC	Abercorn, Zambia	Magosian	Cooler and moister	Pollen	5

	Lab. No.	Date B. P./B. C.	Site	Cultural Association	Climatic Implication	Evidence	Reference
14.	T-341	7000 ± 100 5050 BC	Kafra, Niger	Nil	End of humid period in the Sahara	Lacustrine limestones	14
	T-361	7310 ± 120 5360 BC	Adrar Bous, Niger	"	"	"	"
	T-279	6900 ± 150 4950 BC	Kandel Bouzou, Niger	"	"	Moss and water plants	"
15.	UCLA-167	6830 ± 120 4880 BC	Mufo, Angola	Tshitolian	Warmer and moister	Pollen	1
16.	Y-466	6870 ± 160 4920 BC	Groenvlei, South Africa	Nil	Climate similar to that of today between these dates; followed by wetter conditions	Pollen and Geological	8
	Y-467	1905 ± 60 AD 45					
17.	Lv-17	7840 ± 190 5890 BC	Lemba and	Nil	Wetter	Fossil wood	17
	Lv-45	6030 ± 190 4080 BC	Mt. Gafula, Congo	Late Tshitolian	"	Erosion	6
18.	UCLA-171	4700 ± 100 2750 BC	Calunda, Angola	Tshitolian	Sample too small	Pollen	1

The following additional dates have also been run on cores drilled for studying the pollen sequence, but the details have not yet been published in full. Results from Muchoya Fen, Uganda (see Geological list 17-19) have also not yet been published in full.

	Lab. No.	Date	Site	Cultural Association	Climatic Implication	Evidence	Reference
19.	GrN-4194	33,350 ± 1000 31,400 BC	Sacred Lake, Kenya	Nil		Pollen	15
20.	GrN-4089	27,750 BP	Cherangani, Kenya	Nil		Pollen	15
21.		12,650 ± 200 10,700 BC	Aliwal North South Africa	Nil		Pollen	15
22.		9,000 BP	Lake Naivasha, Kenya	Nil		Pollen	15

ADDITIONAL NOTES ON PALAEOENVIRONMENTAL DATES

1. **GrN-2644. Kalambo Falls, Zambia** 57,600 ± 750
55,650 BC

Five samples for pollen analysis were collected and studied by E. M. van Zinderen Bakker from the Late Acheulian levels. These yielded a total sample of 1527 pollen grains (averaging about 305 per sample and ranging from 150 to 424) and the results showed that the Late Acheulian may be correlated with warmer and drier conditions (5). (Clark (18) states that the vegetation was much the same as that of the present day). There are no finite dates for the final Acheulian phase, but Clark (18) has correlated this cultural phase with cooler and wetter conditions (see below). After comparison between the activity of the modern river with regard to the transportation of pollen, and the modern pollen spectra, it was concluded (5) that the river transport of pollen did not have an appreciable effect on the fossil spectra.

2. **Kalambo Falls, Zambia** **See Early Stone Age list 2-12**

Some 15 further samples (see 1 above) for pollen analysis were studied from the Kalambo Falls deposits between the Late Acheulian and Middle Stone Age (27 500 BP) levels. These represent the final Acheulian, the Acheulian/Sangoan transitional industries and the Sangoan cultural phases. Clark (18) has collated the pollen evidence of van Zinderen Bakker (5) to show that during the final Acheulian phase the climate was cooler and wetter, this phase reaching a climax during the transitional cultural period, and then oscillating during the Sangoan from warmer and drier conditions to probably cooler and wetter, to warmer and probably wetter just before the Middle Stone Age levels. These are correlated with the oscillations of temperature during the Middle Wurm period in Europe and the two curves show a good deal of similarity (5). The Kalambo results are based on 15 samples with a total of 2,782 pollen grains (an average of about 185 grains per sample, ranging between 78 and 423 (5)). The 11 dates for the period are not directly related to the pollen samples which can be said to date to between >52,000 and >32,600 BP.

3. **UCLA-168. Mufo, Angola** 38,000 ± 2500
UCLA-169 36,050 BC
>34,000

A sample of 100 pollen grains from the Peaty Clay in the Lower Gravels of the Flats Terrace at Mufo shows the vegetation to have been very open with less proof for humid conditions (1) during the Sangoan or Lower Lupemban cultural phase than for the Tshitolian wet phase (see this list No. 15). A single **Podocarpus** pollen grain is present but may have been transported by wind over a long distance. Van Zinderen Bakker (1) considers the sample too small for a definite conclusion to be drawn.

4. **Florisbad, South Africa** Y-103 > 44,000
C-850 > 41,000
L-271B > 35,000

Pollen samples from the Peat I with a early Middle Stone Age industry (see Middle Stone Age list 1-7) and associated with the Florisbad skull show the climate to have been warmer and drier than that of today (2).

5. **SR-39. Pomongwe, Rhodesia** 35,530 ± 780
33,580 BC

At the end of the Stillbay Middle Stone Age horizon, Cooke (3) claims evidence for a wetter climate at this period due to increased exfoliation from the roof and walls of the cave. This is possibly substantiated by the work of Bond (4) on the open site of Khami where a study of the size of felspar grains at various levels in the deposit suggests a period of erosion at the end of the Stillbay. SR-39 dates the top of the layer of granite spalls (layer 13) at Pomongwe.

6. **Lv-44. Lemba, Congo** > 30,000
Lv-47. Basoko River, Congo > 30,000

Studies on the geology of the Stanley-Pool area in the Congo has led de Ploey (6) to suggest, on the basis of evidence for intensive sheet erosion, a semi-arid period covering roughly the time period spanned by the Wurm glaciation in Europe. The two dates above, for the Lupemban cultural phase, fall within this period.

7. **L-399I. Kalambo Falls, Zambia** 27,500 ± 2300
25,550 BC

Analysis of a sample of 150 pollen grains from the Lupemban cultural levels shows warmer and probably wetter conditions (5).

8. **L-271C. Florisbad, South Africa. Peat II** 28,450 ± 2200
26,500 BC
L-271D. Florisbad, South Africa. Peat III 19,530 ± 650
17,580 BC

Pollen samples taken from the Peat II to Peat III levels containing Middle Stone Age (Mazelspoort variant) cultural material show oscillating wetter and drier conditions (8). The total sample consisted of at least 950 grains (2).

9. **UCLA-229. Twin Rivers, Zambia** 22,800 ± 1000
20,850 BC

Travertine, incorporating a Middle Stone Age industry, is considered by Clark (7) to have formed as a result of seepage during a cooler and wetter climate.

10. **C-581. Mufo, Angola** 14,503 ± 560
12,553 BC

A sample of 306 pollen grains from the peaty clay of the Upper Gravels of the Flats Terrace associated with an Upper Lupemban or Lupembo-Tshitolian cultural phase, suggests a vegetation growing under cooler but not necessarily wetter conditions than those of today (1).

11. **I-556. Mahoma Lake, Uganda**
14,700 ± 290
12,750 BC

Gyttja dated from the base of a glacial lake and probably indicating the date of retreat of the lowest valley moraines of the Ruwenzori range. The result shows the retreat from the last glacial maximum to have been synchronous with that in Europe and North America (13).

12. **GrN-3048. Cherangani, Kenya**
12,650 ± 100
10,700 BC

Pollen analysis of a core drilled in a swamp in the Cherangani Hills indicates a cold period at the level dated. Van Zinderen Bakker (12) suggests coincidence with the Oldest Dryas in Europe, while on the basis of the rate of sedimentation and the oscillations in temperature indicated by the changing pollen spectra he concludes that the 'Gamblian' pluvial is coincident with the Wurm glaciation in Europe (11).

13. **L-395D. Abercorn, Zambia**
9550 ± 210
7600 BC

This sample is apparently from the Kalambo Falls sequence (see Clark and Van Zinderen Bakker (5) Fig. 1 and Table 2) and analysis of four pollen samples with a total of 924 pollen grains has suggested a cooler and moister climate at the Magosian Second Intermediate level.

14. **T-341. Kafra, Niger**
7000 ± 100
5050 BC

T-361. Adrar Bous, Niger
7310 ± 120
5360 BC

T-279. Kandel Bouzou, Niger
6900 ± 150
4950 BC

Evidence from lacustrine sediments in what is now a desert area for a wetter period. These dates mark the end of that period.

15. **UCLA-167. Mufo, Angola**
6830 ± 120
4880 BC

A sample of some 450 pollen grains from the peaty clay in the sands and and gravels overlying the Upper Gravels of the Flats Terrace and associated with Tshitolian cultural material, indicates a climate which must have been generally warmer and moister than the present (1).

16. **Y-466. Groenvlei, Knysna district, South Africa**
6870 ± 160
4920 BC

Y-467. Groenvlei, South Africa
1905 ± 60
AD 45

Work by Martin (16) in fen deposits at Groenvlei show marine mud intercalated in freshwater deposits indicating a higher sea level falling between the two dates above which are from the freshwater deposits above and below the marine mud. Pollen analysis shows that heath vegetation (similar to that of today) predominated until the return of the fresh water conditions when wetter conditions favoured the establishment of coastal woodland (8).

17. **Lv-45. Mt. Gafula, Congo** 6030 ± 190
4080 BC

On the basis of observations of linear erosion, de Ploey (6) recognises a period of increased rainfall during Tshitolian times in the Stanley-Pool area.

Lv-17. Lemba, Congo 7840 ± 190
5890 BC

A sample of fossil wood collected from a dried-out fen indicating that the site, at present a desert, was occupied by equatorial forest (17).

18. **UCLA-171. Calunda, Angola** 4700 ± 100
2750 BC

Analysis of a sample of 50 pollen grains from peaty clays of the Lower Stream Gravels exposed just below water level showed a spectrum typical of a riverine forest vegetation found today at a slightly higher altitude than Calunda. however, the sample is considered to be too small to allow any definite conclusions (1).

Note: The numbers of pollen grains counted in the palynological samples above are given as a measure of the reliability that can be placed on the climatic deductions that have been made. It is evident from the sources quoted that when there are fewer than 100 grains, the sample is considered too small by the analyst to allow definite conclusions to be drawn. (In Britain, 150 tree pollen grains and in the absence of many trees, 400 pollens from land plants, are considered to constitute a reliable sample (Dr. S. Seagrief, **pers. comm.**)).

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SUMMARY AND CONCLUSIONS

A total of 21 laboratories have processed dates from sub-Saharan Africa and these are listed, with the numbers of dates run by each tabulated according to region, in Table 2. Yale and the recently established laboratory in Salisbury (the only one in Africa) have been most active.

The regional and cultural distribution of the dates is tabulated in Table 1. This shows that Central Africa has the largest number of dates - almost three times as many as South Africa which has the next highest number - and to be the only region with dates from all cultural stages.

Several papers have appeared during the last few years correlating the results of radiocarbon dates in various parts of the world. Jelinek (1) has published an analysis of archaeological dates for the New and Old Worlds published to the end of 1961 and in a series of histograms has recognized apparently significant gaps in the time range. In comparing Fig. 2 of this paper with these results, however, any gaps that do appear are undoubtedly due to sampling as there are as yet too few dates from Sub-Saharan Africa. The most significant similarity between the two sets of histograms would be the rise in the numbers of processed dates with the advent of food production (Iron Age in Africa).

A review of the radiocarbon dates published up to 1959 for sub-Saharan Africa has appeared by Clark (11) whose conclusions are broadly confirmed here. Additional papers on the carbon dates from this region from c. 1000 B. C. to the present have been published in the **Journal of African History** by B. M. Fagan.

Section A of the date list deals with the geological and tree-ring determinations and these require little comment. It is clear that only a start has been made on using the potentialities of the Carbon-14 method for the study of the recent geological histories of, for example, the coastal and inland lakes where old shore lines and related deposits not infrequently contain datable material.

Section C has been compiled largely from dates from the other sections and lists those sites at which evidence has been found for climatic variation. A result of 12,750 B. C. (I-556) has been obtained for the retreat of the last glacial maximum in the Ruwenzori Range in East Africa, while work by Van Zinderen Bakker in the Cherangani Hills of East Africa and elsewhere has corroborated this evidence suggesting that temperature changes evident from differences in vegetation patterns have been broadly synchronous with the stages of the Wurm glaciation in Europe. Detailed discussions of Pleistocene vegetation patterns and cultural development are given in papers by Clark (2) and Van Zinderen Bakker (3). It is obvious, however, that a lot more evidence is needed before a well-dated climatic sequence can be drawn up for the last 50,000 years in Africa, especially as it appears (comparing evidence from the Congo basin cited by de Ploey (9) with that from north-east Angola (Van Zinderen Bakker, 5)) that local regions may have offered differential responses in terms of total climate to apparently world-wide temperature fluctuations.

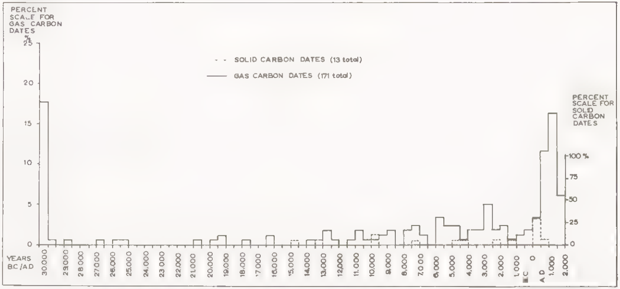

FIG. 2 HISTOGRAM SHOWING TEMPORAL DISTRIBUTION OF 184 RADIOCARBON DATES FROM SUB-SAHARAN AFRICA
Where two dates have been published for a single sample (as where chemically fractionated) both dates have been plotted

Figure 3 shows to what extent the successive cultural stages in sub-Saharan Africa can be defined in terms of absolute time. Attempts to date the final stages of the Chelles-Acheul culture of the Early Stone Age suggest it to be outside the time range of the standard laboratory method. A single enrichment date for the Late Acheulian at Kalambo Falls (GrN-2644) of 55,650 B. C. gives the only finite result, which, because of the limitations of the enrichment process, should be regarded as a minimal date. With determinations from only two sites, Kalambo Falls and Nok, and the latter a geological context, the terminal stages of the Early Stone Age are poorly defined.

Within the limited geographical area of Central Africa, the Sangoan industries of the First Intermediate are fairly well dated within a small temporal range between 32,600 (GrN-3608) and 49,000 (GrN-3211). Nine of the eleven determinations are from Kalambo Falls and the other two are from Pomongwe. If one accepts the apparently uncertain cultural affinities of GrN-3228 as being Sangoan, the finite dates fall between 35,950 B. C. (GrN-3228) and 44,150 B. C. (GrN-3226). The temporal relationship of the Sangoan and Proto-Stillbay cultures in Rhodesia is not clear and it remains to be seen whether, on typological grounds the recognition of two separate cultural stages is warranted. The apparent temporal overlap of the Sangoan or Proto-Stillbay at Pomongwe with the Sangoan industries at Kalambo Falls may suggest that the Proto-Stillbay falls within the range of variation of the First Intermediate cultures (cf. Cooke (6)).

The supposed temporal equivalent of the Sangoan culture in the grasslands area, the Fauresmith culture, remains un-dated. The earlier levels of Florisbad dated at 44,000 B. P. (Y-103) may relate to a First Intermediate industry rather than the Middle Stone Age, but the excavated sample is apparently too small and the assemblage inadequately described.

The 25 dates for the Middle Stone Age are unevenly scattered between 2450 B. C. (BM-34) and 44,000 B. P. (Y-103). Some of the older dates in this series appear to be associated with transitional industries which may be considered as falling either in the First Intermediate or the early part of the Middle Stone Age. These include Florisbad Peat I, Mufo in Angola where UCLA-168 and UCLA-169 were described first by Clark (4) as Lupemban and later (5) as Sangoan/Lower Lupemban, and Pomongwe in Rhodesia where Cooke (6) is uncertain as to whether SR-9 and SR-39 should be regarded as Proto-Stillbay or Stillbay. While the arbitrary typological distinction between the First Intermediate and Middle Stone Age has been the subject of some discussion (MacCalman (7)) it does seem as if the Middle Stone Age in **sensuo stricto** was everywhere later than 40,000 years B. P. The apparent reluctance of the excavators to label the industries as either First Intermediate or Middle Stone Age does, however, indicate that the Middle Stone Age technological innovations were apparently already manifest in Rhodesia by 40,250 B. C. (SR-9) and in North-east Angola by 36,050 B. C. (UCLA-168).

Of the younger dates in this range, the Florisbad determinations of 7154 B. C. (C-851) and 4750 B. C. (C-852) were considered to have been contaminated

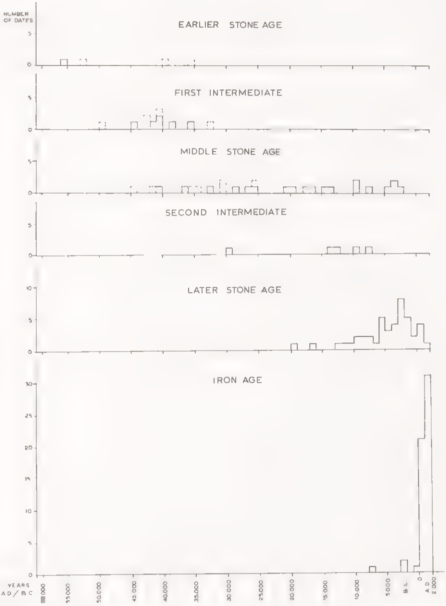

FIG 3 SERIES OF HISTOGRAMS SHOWING TEMPORAL RANGE OF RADIOCARBON DATES IN SUB-SAHARAN AFRICA FOR THE SIX CULTURAL PHASES Geological dates are excluded. Dotted lines indicate dates expressed in 'greater-than' values (>)

and later dates from the same levels gave much older results. The Nok and Zenebi determinations from West Africa, while consistently recent at 3625 B.C. (Y-142-3) and 3490 B.C. (Y-142-7), are from a geological context and the dating of the Middle Stone Age in West Africa requires further check dates from archaeological contexts. The date from Holley Shelter in Natal at 2540 B.C. (BM-34) is, both by virtue of its anomalously early position in the time sequence and because of the discrepancy of almost 14,000 years between it and BM-30 from the immediately underlying 6-inch spit, hardly sufficient evidence to support a late survival of the Middle Stone Age in the southern region of South Africa.

The Cave of Hearths series is not internally consistent, and it would be expected that a greater time interval separates the Earlier and Later Pietersburg which Mason (8) has shown are typologically distinct.

The chronology is not sufficiently complete at this stage to be more than indicative that the Lupemban industries of the forest areas and the Stillbay-Pietersburg industries of the grasslands are broadly contemporaneous. The north-east Angolan series, in part from geological contexts, points to the Lupemban developing from about 38,000 years B.P. to about 14,000 years B.P. This is consistent with dates from various sites in the Congo Basin and Kalambo Falls. At Pomongwe, the Stillbay dates approximately between 36,000 years B.P. and 16,000 B.P., while the Cave of Hearths centres around 13,000 years B.P. The determinations from Florisbad Peat II and III, BM-30 from Holley Shelter, and those from Olieboompoort and Twin Rivers all fall within the time range for the Stillbay/Pietersburg as indicated by the longer series of dates from Pomongwe and the Cave of Hearths.

There are only 5 dates from Second Intermediate contexts. The charred ostrich eggshell material from Kisese has given results, which, by comparison with other determinations, are too old by a factor of almost 2, so that NPL-38 dating the Second Intermediate levels at 29,530 B.C. is suspect and must be rejected. The Mufo dates may relate to the Second Intermediate or to the early part of the Later Stone Age as C-581 at 12,553 B.C. has been described as either Late Upper Lupemban (4) or Lupembo-Tshitolian (5) and would possibly represent a very early stage of the Second Intermediate. C-580 dated to 9239 B.C. has been called either Lupembo-Tshitolian or Lower Tshitolian and would therefore fall at the end of the Second Intermediate cultural sequence. So that, apart from the Magosian dates from Pomongwe and Abercorn it would seem that there are too few dates to delimit this cultural period accurately.

There are more significant numbers of dates for the Later Stone Age (total 44) and the Iron Age (total 56) so that the temporal range can be discussed with more assurance and the anomalous dates become more obvious by their isolation on the histogram.

With the Later Stone Age, Ishango at 19,050 B.C. (W-283) is rejected by the laboratory on the grounds of contamination, and the Kisese dates at 16,240 B.C. (NPL-37), 12,810 B.C. (NPL-35) and 8770 B.C. (NPL-36) are also suspect.

There are two determinations over 10,000 B.C. which appear reliable - from the Lower Tshitolian horizon at Calunda, Angola, and from the ?lower Wilton scraper industry at Tshangula in Rhodesia (UCLA-629). Between 5,000 and 10,000 B.C. there are some 12 determinations of which 5 are from the Kasama and Nachikufu series which are considered by the excavator to be anomalously old, one from Kisese, and another is the younger date for the scraper industry underlying the Wilton at Pomongwe (SR-13: 5740 B.C.). The laboratory and excavator consider this latter date should be rejected in favour of the older date from twig charcoal from the same levels which is dated at 7450 B.C. (SR-12). The five other determinations are from the Wilton and pre-Wilton at Pomongwe and from the Matjes River series. An extrapolated date for Ishango would also fall within this time range. The bulk of the Later Stone Age determinations, however, fall between 4000 B.C. and 1000 A.D., while the most recent date of 1080 A.D. (BM-42) from Olieboompoort attests to the late survival of the Stone Age in South Africa.

The Later Stone Age technology can therefore be said to have developed some 12,000 years ago and to have reached its full expression by about 4000 B.C.

The bulk of the Iron Age results fall between the first and second millenia A.D. Further excavations at Uitkomst Cave, which gave a date of 7894 B.C. (BM-number not published) for the Iron Age horizon in Bed 2 have shown this to be anomalous due to sampling and the result may be rejected from the Iron Age list. A check excavation after the date of 2128 B.C. (C-662) from the early Iron Age site at Situmpa Forest in Zambia again suggests in a re-determination of A.D. 96 (C-829) that the earlier date may be discounted. The unusually early dates from Nok at 2110 B.C. (Y-475) and 925 B.C. (Y-142-4) appear to be anomalously early against the rest of the Iron Age dates and further checking from archaeological contexts is necessary.

The radiocarbon dates clearly show, however, that the Iron Age peoples had penetrated well south into Africa early in the first millenium A.D. They were established in Rhodesia in the first half of this millenium and as far as can be seen at this stage, appeared south of the Limpopo at least as early as 1000 A.D. More Iron Age dates from East and Equatorial Africa are undoubtedly needed to fill out the information we have on the spread of Iron Age technology south of the Sahara.

The general results available thus far are encouraging and have given a measure of the range of time occupied by the successive broad sub-divisions of the cultural sequence in sub-Saharan Africa. However, the detailed chronology of industries within this broad framework in most regions is sketchy and many more dates are needed before the full potential of the Carbon-14 method is exploited.

At present too much reliance is perforce placed on a few relatively well-dated sequences and confirmation of such results from other sites is clearly desirable. Apart from such confirmation of results which have already been received, however, two other significant points emerge from the dates reviewed here which should be borne in mind when new samples are submitted for dating: firstly, a large series of dates is needed before a cultural phase can be accurately dated even in a limited geographical area: and secondly, the excavator should be certain of the cultural associations of the sample submitted for dating as a tendency has been noted for the culture to be fitted to the date rather than the date to the culture and such uncertainly associated determinations often become more misleading than useful. As pointed out by Movius (12) in discussing radiocarbon dating as an invaluable archaeological method: "but like all fine tools this one must be kept sharp, and handled with care and perception: the most promising excavation site cannot possibly be expected to yield results without the brain, hand and eyes of the excavator".

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TABLE 1

NUMERICAL ANALYSIS OF RADIOCARBON DATES FOR SUB-SAHARAN AFRICA BY REGION AND ASSOCIATION

	Geological/ Botanical	Early Stone Age	First Intermediate	Middle Stone Age	Second Intermediate	Later Stone Age	Iron Age	Total
South Africa	9	–	–	14	–	9	6	38
Central Africa	6	3	11	9	4	31	42	106
East Africa	8	–	–	–	1	4	4	17
West Africa	10	1	–	2	–	–	2	15
Other	3	–	–	–	–	–	2	5
TOTAL	36	4	11	25	5	44	56	181

TABLE 2.

LIST OF LABORATORIES WITH ADDRESS AND CODE LETTERS, FOLLOWED BY NUMBERS OF DATES PROCESSED FOR SUB-SAHARAN AFRICA TO 1964 INCLUSIVE[1]

Code Letters	Laboratory	South Africa	Central Africa	East Africa	West Africa	Other	Total
B	Universitat Bern, Bern, SWITZERLAND		2				2
BM	British Museum, London, ENGLAND	6	1	1			8
C	University of Chicago, Illinois, U.S.A.	8	8				16
GaK	Gakushuin University, Mejiro, Toshima-ku, Tokyo, JAPAN					2	2
GL	Geochronological Laboratory Instutute of Archaeology, London, ENGLAND		1				1
GrN	Natuurkundig Laboratorium der Rijks-Universiteit, Groningen, NETHERLANDS		11	1			12
GX	Geochron Laboratories Inc. Cambridge, Mass. U.S.A.		1				1
I	Isotopes Inc. Westwood, New Jersey, U.S.A.			1			1
L	Lamont Geological Observatory Columbia University, Palisades, New York, U.S.A.	7	9				16
Lv	Centre de Physique Nucleaire, Av. Cardinal Mercier, Heverle Louvain, BELGIUM		4				4
M	University of Michigan, Ann Arbor, Michigan, U.S.A.		5	2			7
NPL	Applied Physics Division National Physics Laboratory Teddington, Middlesex, ENGLAND			7			7
Q	University Sub-Department of Quaternary Research, Botany School, Cambridge, ENGLAND		1			2	3
R	Radiocarbon Dating Laboratory University of Rome, Citta Universitaria, Roma, ITALY	1					1
R(NZ)	Institute of Nuclear Sciences Lower Hutt, NEW ZEALAND		2				2
SR	University College of Rhodesia and Nyasaland Salisbury, RHODESIA	4	29				33
T	Radiocarbon Dating Laboratory The Norwegian Institute of Technology, Trondheim, NORWAY				7		7

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[1] Total 178 as three of the dates have been published without their laboratory numbers.

TABLE 2 (cont.)

Code Letters	Laboratory	South Africa	Central Africa	East Africa	West Africa	Other	Total
U	**Institute of Physics University of Uppsala Uppsala, SWEDEN**				3		3
UCLA	**Institute of Geophysics University of California Los Angeles 24, U. S. A.**		13				13
W	**U. S. Geological Survey Washington 25 DC, U. S. A.**	1	2	1			4
Y	**Radiocarbon Laboratory Yale University New Haven, Conn. U. S. A.**	11	14	4	5	1	35
	TOTAL	38	103	17	15	5	178